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KENYA'S MODERN PORT.

The Supplement in this issue illustrates the new wharf and transit shed accommodation at Kilindini, which is the modern port of Kenya, the East African Protectorate, bounded by the Indian Ocean to the east, Italian Somaliland on the north-east, Abyssinia on the north, the Sudan on the north-west, the Belgian Congo on the west, and the mandated territory of Tanganyika on the south. Until very recent times the harbour for the area now known as Kenya was the historic port of Mombasa, the outward trade being ivory, hides and rubber. The impress of the Eastern tradition on Mombasa is discernible in the illustration of the old port, which appears in the course of the article by Mr. George Bulkeley, who is the port manager of Kilindini. Perhaps it would not be too much to say that the regime of port administration for the past few years has transmuted the Eastern tradition in harbour works in these environs to the modern practice of the West. The idea of a harbour simply as a beneficent accident of Nature is, in short, giving way to the will for improvement, and its application in artificial deepening of approaches and channels, and the position of the most suitable berthing accommodation that the wit and science of the port engineer can devise.

The immediate topography of the Port of Kilindini is represented in the top right-hand corner of the Supplement, whilst on the left is the plan of the new wharf and transit shed accommodation, opened for traffic on August 22nd, 1926. A typical cross section of the wharf appears at the bottom.

There is a rubble apron on the river bed fronting the wharf, whilst the main mass of the foundation is of 7 to 1 concrete blocks backed on the land side by coral rubble, the adjoining ground slope running upwards at an angle of 45 deg. Immediately capping the concrete block foundation is 7 to 1 concrete in mass, the whole structure at the waterside being faced with blocks. The upper section of mass concrete is backed by punned filling, whilst proceeding inland the foundation of the double-storey transit sheds is made up of filling from cliff excavation. The arrangement of the drainage and water supply may be seen from the section in the Supplement. The new accommodation comprises transit sheds Nos. 1 and 2, each 114 ft. long and 120 ft. wide.

Equipment at the new wharf shows twenty-eight cranes against seven at the old wharf, the present plant comprising eight 3-ton electric cranes, ten 1-ton electric bracket warehouse cranes, fixed on the sheds, eight 1-ton electric overhead under-slung jib cranes inside, whilst there is a 5-ton and a 10-ton electric travelling crane on the stacking ground. The 3-ton electric cranes have a maximum radius of 53 ft. and a maximum outreach from the edge of the wharf of 41 ft. 6 in. It may be noted that the 20-ton fixed hand crane on the old wharf had a maximum radius of 20 ft. and a maximum outreach from the edge of the wharf of 14 ft. 6 in. The old 5-ton, 3-ton and 2-ton steam cranes had a maximum radius of 24 ft. and a maximum outreach of 15 ft. 6 in. from the edge of the wharf.

The electric sub-station and mechanical workshop is on the inland side of the roadway running behind the new transit sheds. Further extension of the quay is in progress, and the completed length under the present scheme will be 1,012 ft.

NAVIGATION RIGHTS ON THE DANUBE.

The Permanent Court of International Justice, on December 8th, says "The Times," delivered its opinion upon the questions concerning the jurisdiction of the European Commission of the Danube, in regard to which its advice had been asked by the Council of the League of Nations by a resolution passed on December 9th, 1926. Reduced to simple form, these questions were as follows:—

Under the law in force has the European Commission the same power on the maritime section of the Danube from Galatz to Braila as for the section below Galatz? How far upstream do the powers of the European Commission extend on the Danube?

Do the powers of the European Commission between Galatz and Braila extend over one or more zones, territorially defined, excluding harbour zones, also territorially defined, and subject to the competence of the Rumanian authorities? If not, on what basis is the exact dividing line between the respective competence of the European Commission and of the Rumanian authorities to be fixed?

The Court's reply is as follows:—

The European Commission has the same power on the section of the Danube from Galatz to Braila (inclusive) as below Galatz. These powers extend over the whole of the maritime Danube and are not excluded from any zones whatever, the criteria for the dividing line between the respective competence of the European Commission and of Rumania being, first, navigation in the sense of the movement of ships as part of the voyage, and, second, the obligation of the European Commission to ensure freedom of navigation and equal treatment to all flags; even in ports the European Commission is competent as regards everything relating to navigation in the sense above mentioned and to the fulfilment of its obligation.

GRAIN MOVEMENTS AT LAKE PORTS.

On October 20th no less than 7,318,000 bushels of grain were weighed into elevators in Western Canada along the lines of the Canadian National and Pacific Railways. This year's grain crops are now moving quickly, the present record being one million bushels in excess of the total for the previous day. Car loadings are approaching the record figures with a total of 3,290 car loads during the day. At the Lake ports, Fort William and Port Arthur, eight grain boats took on cargoes totalling 1,989,000 bushels.

The volume of wheat handled at the head of the Great Lakes during the year ended August 31st, 1927, as revealed by the Annual Report of the Lake Shippers' Clearance Association, was 244,484,168 bushels, the largest since the inception of the organisation. The association also handles 18,000,000 bushels of oats; 13,000,000 bushels of barley; 4,000,000 bushels of flax and 7,000,000 bushels of rye. Elevators were constructed during the year with a capacity of 9,500,000 bushels.

CANAL AND DOCK DEVELOPMENT.

The Preliminary Report, No. 24, of the Third Census of Production, carried out under the auspices of the Board of Trade, deals with gas, water, electricity, canals, docks, harbours, tramway and light railway undertakings for the year 1924, and compares results with 1907.

The work of construction, maintenance and repair work carried out by employees of canal, dock, harbour and similar bodies during the years 1924 and 1907 came to a total of £867,000 for 1924 and £862,000 for 1907.

The total value of work carried out by employees of local authorities on harbours and docks, rivers and canals, sea walls, embankments and defences and dock railways amounted to £3,622,000 in 1924 and £1,846,000 in 1907. The changes in price levels during the interim from 1907 to 1924 must, of course, be cardinal considerations in comparing the actual amount of work done.

In 1924 railway companies carried out work valued at £1,748,000 on docks, wharves, canals and waterways, as against £738,000 in 1907.

MANAGEMENT AND MECHANICAL GRAPHICS.

The observations of Mr. T. G. Rose on "Management Graphics" in his lecture on that subject at the Junior Institution of Engineers, London, on December 9th, constituted a useful reminder of the value of this branch of mathematical science. Although the subject was treated with a view to indicating its general helpfulness to the man of affairs, the principles elucidated are capable of very wide application. There must indeed be quite a number of port authorities whose internal economy would gain by the use of graphical representation in showing the course of their affairs, both on the commercial and mechanical sides.

Referring to the conduct of business organisations in general, Mr. Rose said that too often there was no proper system of control of general management and internal administration. Many recorded figures were useless, information which was really vital was not available, and no effort was made to investigate cycles or trends, or cause and effect, so that the loyal efforts of subordinates were often nullified by a vagueness of policy and ignorance of facts among those in control. Certainly his statement was axiomatic when he said that all sound management was based on comparison of results; the mere noting of a result being usually of little interest. Since in any business the results of different departments were bound to influence each other, and in many cases the relation of the result of one department to that of another was of great importance, it followed that unless some clear pictorial form of regarding these results were used, the difficulty of following figures from column to column became so great that comparisons were impossible.

The lecturer went on to say that there were very few statistics which could not be shown with advantage as trend charts, and by superimposing two trend charts, each showing actual results, cumulative results, and the moving annual total, an immediate answer could be obtained to the question "Are we doing better or worse than last year?" And no amount of statistics or schedules could be as effective or telling.

Although members of the larger bodies in the domain of port administration have long maintained a special section for the collation of statistical data, it is a moot point whether much of this material has not been vitiated by the mode of presentation. Many a time the moral of the figures might have been more strikingly portrayed by following the periodical results of a department in regular sequence as they accrue, be the basis a daily or a monthly return. One of the most elementary and yet vital curves is that of the daily movement of goods inward and outward, either by weight, bulk or value.

There is the reasonable enough objection that however much attention is given to the stimulation of trade in a port, no amount of graphical work can increase the flow of merchandise one way or another. On the other hand, a comprehensive application of the device will enable the port manager to put his finger on the spot where symptoms of the malady appear and to arrive at a more perspicuous diagnosis than could be induced by a mass of figures in the crude state. The tangible conclusions possible by this method are indeed likely to be more scientific in character and certainly more likely to command support than a remedy evolved through a cloudy genesis of "laissez faire." In some cases the method may indeed point to the remedy within.

The value of graphical records in seaport operation received detailed attention in a monograph which appeared in the issue of January, 1926. The viewpoint taken was essentially that of the docks traffic superintendent concerned with getting the best out of his cranes, handling equipment and wagons. Quite another sphere of application is the purely maintenance side of dock work in so far as it shows the fluctuating costs of producing power and keeping the machines running. One of the most recent instances of the use of graphs to this end was furnished by Mr. D. E. Cameron, M.I.Mech.E., Mechanical Engineer to the Great Western Railway at Port Talbot, South Wales, in the course of a lecture, in London, on December 15th. Mr. Cameron gave some interesting particulars and showed actual specimens of graphs illustrating the components of cost in producing hydraulic power for working dock-side appliances.

THE CONDITIONING OF TIMBER.

Many of our readers are familiar with the valuable publications of the Department of Scientific and Industrial Research. One of special interest is "The Air-Seasoning and Conditioning of Timber," by Major F. M. Oliphant, Assistant Director of Forest Products Research. In a prefatory note it is stated that the report was prepared with a two-fold object, first to discuss the fundamental factors governing the process of drying timber, and secondly to illustrate the methods by which each factor can be utilised to season it to the best advantage. It points out that although many persons in the timber trade can successfully season those species of timber in which they are interested by virtue of long experience, all interested in timber and its seasoning are not so knowledgeable, whilst it was thought that even those proficient in the art might not be fully conversant with all the factors which governed the process.

Of these factors the more notable are the anatomical structure of the wood, the varying percentages of moisture which it may contain under different conditions, and the effect of heat and air circulation on moisture movements.

Emphasis is laid on the fact that seasoning in all its aspects is the primary factor governing more extensive utilisation and the conservancy of world supplies of timber. A well-seasoned piece of wood is more durable than when in a green state, thus delaying the period of renewal, with a consequent saving in demand; it is stronger when dry than in a green state and therefore less liable to break, besides allowing smaller dimensions to be utilised, factors also tending to reduce requirements; while by proper seasoning and consequent elimination of defects, even greater saving can be affected by careful conversion.

The close connection which seasoning has with the prevention of decay has led to a brief summary of the causes and conditions of decay being included as a special appendix.

Thanks are expressed to the United States Forest Products Laboratory described in the report as the pioneers in such work and to Dr. C. G. Forsaith, New York State College of Forestry, Syracuse, U.S.A., lately in charge of the section of the Properties and Structure of Wood, Imperial Forestry Institute, Oxford.

The three main objects of seasoning wood, says the report, are to reduce its weight, and therefore the cost of transport, to increase its durability and to prevent undue shrinkage and swelling, with consequent splitting and warping, when the finished product is in use. These objects are principally achieved by reducing the moisture content, but a wider interpretation of the term seasoning is advised. It is recognised that time is required to allow the moisture remaining in wood to distribute itself evenly and the probability of the passage of time being accompanied by a gradual disappearance of any stresses set up within the timber during drying, and of further chemical changes taking place with an increase in stability and hardness.

In examining the structure of wood, stress is laid on the fact that it is neither a solid nor a homogeneous material, being made up of various kinds of tube-like cells, the walls of which are at first only a thin membrane. This becomes thickened during growth and modified by the addition of, or change into "lignin." To this alteration and thickening called "lignification," the wood doubtless owes its stiffness and strength. Further, the cell-wall may be impregnated with other substances giving special characteristics to particular woods. The substances—such as lime, salts and silica, dyes, organic acids, alkaloids, tannins, oils and resins—may occur in the cell-cavities as well as in the cell-wall; the cell-cavities may likewise contain starch, sugars and nitrogen compounds. Associated with the cell-wall are other substances called "pectins," but their significance and whether they are true pectin is, as yet, uncertain.

In the so-called "soft woods" (coniferous timbers) the wood consists mainly of cells called "tracheids," which are narrow, elongated and somewhat tapering elements serving the double purpose of giving strength to the tree and conducting water. The tracheids formed during the spring are concerned mainly with water-conduction and have rather thin walls and a comparatively large bore. Those formed during the summer have much thicker walls and a small bore, and provide the strength.

In the so-called "hardwoods" (broad-leaved trees) the functions of strengthening and water-conduction are performed by two different types of cells. The cell responsible for strength and stiffness is the "fibre." It is a narrow, elongated, thick-walled element, which tapers to a point at both ends and has only a very small bore. Water-conduction is represented by the "vessels," which, when referring to the cross section are commonly called "pores." They are for the most part comparatively wide, short cells with more or less open ends, and are linked up to form a continuous tube for the passage of water. The vessels vary considerably according to the species of tree, and are therefore useful for the identification of timbers.

Other influences considered in the report are the percentage relative humidity in the air and the significance of weather statistics in relation to the piling of wood for seasoning. The data is accompanied by a number of micro-photographs and an appendix dealing with the decay of timber caused by fungi. The facts presented are ones of which harbour engineers should be cognisant especially those specialising in timber structures.

JUNIOR INSTITUTION OF ENGINEERS.

It is the practice of the Junior Institution of Engineers, 39, Victoria Street, London, S.W.1, to hold periodical meetings at which any questions or discussions of engineering interest may be raised by the members. The effect of these meetings one of which was held on December 2nd, is not only to supply information to those members who seek it, but also to indicate to the management of the Institution matters which might usefully form the subject of future papers or lectures. Some of the topics discussed at the last meeting had reference to high pressure steam (arising from the previous week's lecture by Mr. L. P. Perkins), water cooling of pistons in Diesel engines, water-proofing of concrete hoppers, refrigeration cabinets and artificial silk machinery.

The Port of Venice.



Sacking of Wheat at the Quayside, Port of Venice.

COTTON IMPORTS.

According to the latest statistics concerning the development of trade through the Port of Venice, the following are figures in tons of the cotton imported during the period from January to September, 1927:—

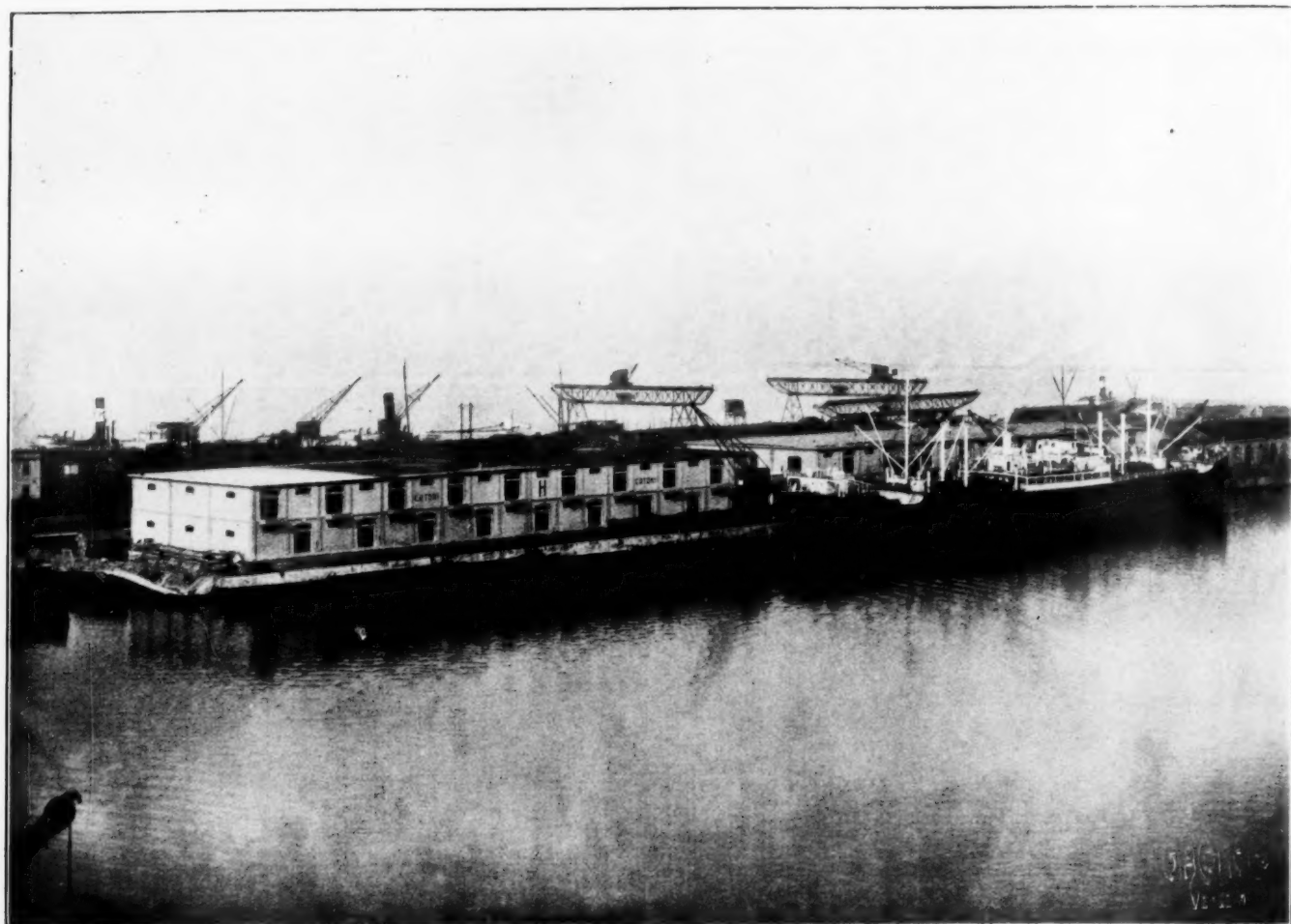
Genoa	...	...	...	111,164
Venice	...	...	...	52,648
Trieste	...	...	...	38,917
Naples	...	...	...	1,823
Leghorn	...	...	...	2,151

As it can be seen, Venice occupies the second place among cotton importing ports in this country, and under these circumstances particular importance attaches to the fact that recently a new warehouse has been inaugurated occupying an area of about 15,000 metres, and measuring 230 metres in length, and 33 metres in breadth, where over 20,000 bales of cotton can be stored at once on one range. The cost of this building reaches about five million lire.

NEW WAREHOUSE.

The new building is the last word in regard to harbour improvements, since everything has been employed to increase

The Port of Venice.



A General View of the New Cotton Warehouse at the Port of Venice.



Interior of the New Cotton Warehouse at the Port of Venice.

Handling Bales of Cotton.



Unloading Cotton into Sabiem Cars from a Vessel at the Port of Venice.

the speed in the unloading and shipment by railway. Instead of the old small hand cars, which could only carry one bale of cotton, electric cars, having a capacity from five to six bales, have been purchased from the Società Anonima Bolognese Industrie Elettromeccaniche of Bologna (Sabiem), with a great reduction in the expenses. Cotton is unloaded from the ship by cranes (six bales per time), taken into the warehouse by these electric cars, and then weighed and sampled and shipped at once into the hinterland without necessitating any storage, and this represents a considerable advantage as, apart from the fact that ten days' free storage is granted in the Venice

Harbour for cotton, spinners require immediate shipment of the goods. This is because the situation of industry is such that they cannot order large shipments of raw material, and consequently, if they do not get goods travelling in time they have to stop work.

As can be seen, the idea of furthering general cargo trade through Venice is a *fait accompli*, and there is no reason why it should not increase, taking into consideration that through the re-establishment of discipline, it has been possible to reach the following unloading capacities per day and per hatch: 500 bales of cotton; 400 tons of phosphates; and 300 tons of wheat.

Mersey Docks and Harbour Board.

Chairman's Review of the Year's Work.

At a meeting of the Mersey Docks and Harbour Board held on December 1st, the Chairman, Mr. R. D. Holt, gave an interesting review of the progress of the Board's work. He said:—

"The accounts for the year ending July 1st, 1927, duly audited, are now before you and it becomes my privilege, in accordance with our custom, to submit to you a review of the year's work.

"Turning, in the first instance, to the accounts you will observe that the expenditure on capital account has risen during the year by approximately £860,000, to £41,377,000. Substantially the whole of this money has been spent upon the Gladstone Dock and the new entrances at Birkenhead, and it is reasonable to anticipate that the current financial year will see the end of the expenditure on these objects.

"The revenue account shows a marked improvement on that for last year; rates and dues, the test of the volume of trade, showing an increase of £130,000. The receipts from the warehouses have fallen off to the extent of £30,000, but this is not necessarily unfortunate, as low receipts from warehousing indicate low stocks and low stocks suggest brisker trade in the near future.

"We are able to place the full amount of £100,000 to our Sinking Fund and to carry £19,000 surplus to our Unappropriated Receipts Account and, though we are not able to add to the still large reserves in our insurance and depreciation accounts, it should not be forgotten that, during the year, we have paid at least £300,000 in interest on the works under construction, a payment which, in other undertakings, is not uncommonly added to capital.

FINANCE.

"During the past year Bonds to the value of £2,810,157 fell due for renewal, the average rate of interest on which was £5 6s. 5½d. per cent. Of these, £1,886,146 were renewed at an average of £5 2s. 9½d. per cent. and new money to the amount of £1,662,418 was borrowed at an average rate of £5 3s. 0½d. per cent., partly to replace the bonds which were paid off and partly to pay for the new capital expenditure. All these borrowings took place at par, and the commissions paid amounted in the aggregate to £3,079. It will, therefore, be seen that the Board has not been extravagant in the terms on which it has borrowed.

"It is important that the public should realise the great burden which has fallen upon the administration of the port by reason of the general rise in the rate of interest. On June 30th, 1914, British 2½ per cent. Consols stood at 75 and gave a yield of £3 6s. 8d. per cent., and in that year the average rate of interest paid by the Board on the bonds issued was £3 16s. 5d. per cent. On the 30th June, 1927, Consols stood at 54½ and gave a yield of £4 12s. 2d. per cent., while the average rate of interest paid by the Board on its bonds was £5 3s. 6d. per cent. Seeing that the purchaser of Consols has a real prospect of an increase in capital value if the National Credit improves and that no such prospect exists for the bondholder, the credit of the Board as compared with that of the British Government is at least as favourable as it was before the War, and it is certainly reasonable to assume that the rate of interest paid by the Board will rise or fall in sympathy with that paid by the Government. The Bond debt amounts to 23¼ millions, so that a restoration to the pre-war of interest, 1½ per cent. less than that of the present day, would relieve the trade of the port of a burden of about £300,000 annually.

"I commend this question of the rates of interest to all who are desirous of reducing the burdens on trade.



Transhipment of Cotton into Railway Car, Port of Venice.

COAL DISPUTE.

"It will be of interest to note the effect of the Coal dispute upon the Board's accounts. There was an increase in revenue of £75,000 in respect of dues on vessels carrying coals from foreign ports and of £49,000 in the dues on the coals, a total of £124,000. On the other hand, during the period of the stoppage 90,000 tons of coal would have been consumed at a cost of as many pounds sterling, whereas the consumption had to be restricted to 70,000 tons, costing £137,000, a loss of £47,000, which would have been much greater had there not been 30,000 tons of coal in our reserve stock. The Board, therefore, made an apparent gain of £77,000, against which must be set a large but wholly unascertainable loss in dues on ordinary merchandise, particularly exports of manufactured goods, and the fact that some important work had to be omitted or postponed.

"I now turn to the Engineer's report of the Dock Works, of which I do not propose to offer an abridgment. It is impossible to treat of the Gladstone Dock as it was on July 1st last—the memorable and gracious opening of that dock on July 19th by His Majesty The King, accompanied by Her Majesty the Queen, has turned the records of the progress of the work into ancient history which has little interest to-day.

"The dock is open, the two branches complete in all respects, and business there is being carried on in full swing and, to the best of my belief, those who are occupying the accommodation are very well pleased. The entrance is proving of great value to vessels berthed in the Northern System of Docks, as they are enabled to pass to and from the river many hours later or earlier than would have been possible otherwise. The following examples will be of interest:—

"The s.s. *Baltic*, 23,884 tons gross, 30-ft. 4-in. draft, was able to undock 3 hours 23 minutes before high water on the 3rd September. On this occasion the *Baltic* was able to remain in her berth for 11 hours longer than she would have been able to do had she been berthed in the Huskisson Dock.

"A medium-sized vessel like the s.s. *Nova Scotia*, 6,796 tons gross, drawing 22 ft. 9 in., was able to leave 6 hours 11 minutes before high water on the 1st November.

"The s.s. *Lady Limerick*, a coaster, 1,944 tons gross, drawing 16 ft., was docked 6 hours before high water on the 3rd September, an example of a vessel being able to dock at low water.

"Another case of a coaster, the *Lady Louth*, 1,870 tons gross, with a draft of 15 ft. 8 in., docked at 8.30 a.m. on the 17th November (2 hours 56 minutes after high water) and was berthed at the Nelson Dock at 11.30 a.m. If she had not been able to lock in at Gladstone she could not have docked via the Salisbury Entrance until about 5 p.m., high water being at 6 p.m. Therefore this vessel and her cargo saved a whole afternoon and, in all probability, a considerable expense in overtime.

"The Graving Dock, which has been out of commission since March 1st, 1921, is being brought into commission again early this month, and has been much improved by the installation of mechanically operated blocks, which will greatly facilitate and cheapen dry-docking operations.

"It is hoped that before the end of the present financial year the single-storey sheds on the west end of the north side and the north end of the west side will be completed—providing admirable accommodation for deep-drafted vessels loading outwards cargoes.

"There is little doubt that if the traders and shipowners will take full advantage of the facilities offered at this new system, including those for warehousing goods on the quay, something material may be done towards cheapening the port.

"I would emphasise the fact that the Board alone cannot cheapen the port—there must be co-operation to this end by traders of all classes, particularly in the intelligent use of facilities provided and the avoidance of unnecessary operations, and I would particularly commend a careful reconsideration of the system of cartage and warehousing now prevalent throughout the port, which is a matter for the traders rather than for the board. So far as I am able to judge there is a greater field for the reduction of expense in this direction than in any other.

"The work at the Alfred Entrances to our Birkenhead System was suspended early in June, 1926, owing to the necessity of economising in coal, and recommenced in February this year and, inevitably, the completion of this work has been delayed. Apart from this, the work has made satisfactory progress, the more difficult part, from an engineering point of view, has been successfully dealt with and the new entrance should be available for traffic before the end of our financial year.

CONSERVANCY.

"It seems convenient to deal with the Conservancy separately from the other activities of the Board. The account is in a satisfactory condition, as we have completely wiped out the deficit of £102,000, and have also been able to make an addition of £43,000 to the Renewals and Depreciation Account. The Conservancy did receive a substantial windfall in the extra dues payable by the vessels importing coal during the stoppage in our coal mines and we can hardly expect so good a revenue

during the current year. Moreover, it will be necessary to spend a good deal of money on Conservancy work, particularly in training the channels, and having regard to the considerable element of uncertainty attending these operations, it will be desirable to defray some part of the cost out of revenue, and to keep down the capital expenditure so far as is reasonably possible.

"The question of the pollution of the river by sewage was raised before the Parliamentary Committees dealing with the various local Corporation Bills, and an agreement was reached that the whole question should receive the consideration of a Commission of Enquiry. I hope and believe, with some confidence, that it will be possible to pursue this very important subject, not in the spirit of controversy but of collaboration, to secure the best results in the common interests. I feel assured that those who are responsible for the administration of our great municipalities realise that their prosperity and, indeed, solvency, are bound up with the maintenance of the Mersey as a river navigable by the best and largest ships afloat, and with that maintenance being secured as economically as possible; while we in this room do recognise that our interest and that of the traders whom we represent is bound up with the economical administration of the municipalities, and that to impose upon them in respect of the treatment of sewage or any other matter an expense which is properly avoidable, is to injure ourselves gravely by adding unnecessarily to the burden of rates. The municipalities and ourselves are partners in a common enterprise—each charged with the direction of a different department of the business, and with the realisation of this fact there should be no difficulty in working harmoniously towards the common goal.

"Finally, I desire to acknowledge in the most cordial manner the services of the Board's staff—than whom I know of no more competent body of men. It was our staff who organised the arrangements connected with the opening of the Gladstone Dock, which have been the subject of universal admiration for their efficiency, and the same standard is maintained in work which does not attract so much public attention but is of equal value. Both the Board and the traders are greatly indebted to our staff, and they have our thanks and best wishes."

Drinking Water from Sea Water.

By E. T. ELLIS.

It has long been known that drinking water can be prepared from sea water, but it is only comparatively recently that actual processes have been developed to any extent.

It is my opinion that ultimately all the drinking water which is required will be obtained from sea water during the voyage, and at the same time aerated waters will be prepared from sea water, utilising the waste carbon dioxide from the funnels at the same time.

PRECIPITATION IMPRACTICABLE.

Most of the numerous processes based on the precipitation of the salt and other chemicals contained in sea water are quite impracticable. Complete removal is comparatively uncommon, while if all the sodium salts are taken out there is generally left a relatively large proportion of other salts, and to remove these further precipitation operations have to be conducted. Let us, therefore, rule out the precipitation idea, and devote our attention to others which can be manipulated more quickly and with less difficulty.

PRELIMINARY PROCESSES.

In every instance certain preliminary processes have to be conducted, and a word or two may, therefore, be given about these. First of all, filtration through very fine mediums is desirable, to remove both organic and inorganic matter which may be held in suspension. Mechanical filtration is generally necessary, and while coarse filter papers are often used to start with, to facilitate the rapid removal of the grosser impurities, in such stages, and in any case the final operation is carried out with the object of preventing more than the minutest traces of these materials from gaining access to the filtrate.

One writer points out that it is advisable to pass the sea water through column separators or other appliances to remove any oil which may be mixed with it. Harbour waters and dock waters, where, of course, the amount of oil is generally appreciable, are rarely, if ever, used in the preparation of drinking water.

Having filtered the liquid a small portion should be evaporated to dryness in order that the total solids per gallon may be estimated. Where the percentage of these is appreciable the water may be regarded as unsuitable for the preparation of drinking water, and further investigation will show that the salts in solution are derived from manufacturing operations on the shore. Deep sea water, therefore, is the best for our purpose, and should always be used if possible.

Some technical authorities recommend an analysis of the solids being made, as if the sea water contains readily volatile chemical impurities, it may be assumed that many of these will

be deleterious, and the drinking water obtained will contain some or all of them.

FREEZING OUT SALT-FREE WATER.

The first actual process of obtaining drinking water from sea water consists of freezing the liquid gently.

If this is done it will be found as a rule that a thin film of ice forms on the tops of the vessels, and when this is removed and washed with very cold pure water it will yield on being melted drinking water almost free from salt and other similar impurities. If the mother liquid is again gently frozen a further sheet of ice may be obtained, and in some instances as many as six similar sheets may be taken from each vessel before the melted ice shows the presence of impurities.

Very careful control of the temperature is absolutely essential if this method of obtaining drinking water from sea water is to prove safe, and when no further ice separates readily on again reducing the temperature several degrees, it may be assumed that the limit has been reached, and that it is time to start operations on a fresh supply of sea water.

DISTILLATION AT DIMINISHED PRESSURE.

The second method of obtaining drinking water from sea water consists of submitting filtered liquid to distillation under diminished pressure.

This is relatively easily carried out, as only a partial vacuum is, of course, required, and machines of many types capable of partially exhausting the air of the stills are available.

When distillation is carried out under reduced pressure the sea water vaporises obviously at a much lower temperature than it ordinarily would. By this means, therefore, a considerable economy in fuel may be effected, and this is well worth making in these days when the price is so high.

The vapour is condensed in the usual water-cooled vessels, but being at a much lower temperature it cools more easily. Time, therefore, as well as fuel is saved; this again is obviously an advantage.

LOW TEMPERATURE DISTILLATION.

Another way of obtaining drinking water from sea water is by submitting it to what is called low temperature distillation. The filtered liquid is put into stills of the usual type, but these are heated only just about to the boiling point of the liquid, i.e., so that steam comes over, but so that very little agitation or actual ebullition takes place.

The steam is condensed in relatively large vessels, over which a constant stream of cold water must flow, or other arrangements must be made to liquify it. Ordinary cold sea water can be used, of course, as the condensing medium, since there is no danger as a rule of its finding its way actually into the condensers.

In low temperature distillation, there is great loss of time. Against this, however, we must put a substantial saving of fuel which is invariably effected. In those instances, therefore, where fuel is expensive and time relatively unimportant, low temperature distillation may be recommended with every confidence.

HIGH TEMPERATURE DISTILLATION.

This obviously is the most usual way of obtaining drinking water from sea water. The temperature of the filtered liquid is rapidly raised until vapour comes off quickly, and the whole of the remaining liquid boiling violently. For the first few minutes the steam is not collected, as the water it will condense into is never pure, frequently containing many dissolved gases in small quantities. After this the water-cooled condensers are fitted on, relatively large quantities of cold water being required to liquify the steam completely. From time to time the temperature of the vapour is tested, and any sharp fall in it towards the normal boiling point must be remedied, otherwise time will be lost.

The distillation is usually continued either until some salts are deposited on the sides of the stills, or until the steam carries over with it traces of salt.

While one distillation is by some considered sufficient, it is better to re-distil the distillate in other stills. Very pure water is then obtained, which can be lightly aerated by means of oxygen, or can be strongly aerated with carbon dioxide when the so-called soda water is required.

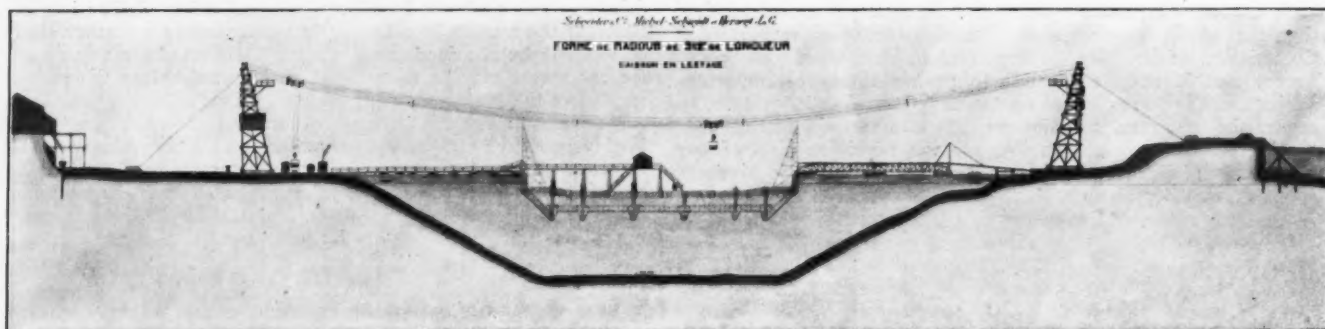
PORT OF VIGO FACILITIES.

The Department of Overseas Trade has received from the British Vice-Consul at Vigo a report on the port facilities and charges at that port. Some of the principal items dealt with include harbour facilities, official port charges on ships, including pilotage and towage, together with some indication of the charges incurred by cargo when landed for delivery to warehouse within the port limits and the cost of rail transport from Vigo to the interior as far as Monforte.

A copy of the report may be consulted by firms of British origin, capital and control upon application to the City Office of the Department (Shipping and Transport Section), 72, Basinghall Street, London, E.C.2.

The New Havre Graving Dock.

French Port's Latest Installation put in Commission.



A Cross Section of the Caisson during Sinking Operations in the Construction of the newly-opened Havre Dry Dock.

THE new graving dock of the Port of Havre was put into commission on October 26th, 1927, for dry docking the ss. *Paris* of the French line. Everything worked splendidly on this occasion.

Through the courtesy of Mr. Michel Schmidt, the contractor and a prominent figure in the engineering world, we are able to publish details of this large new dock.*

* Photos by M. Joseph Olivery, Havre.

DIMENSIONS.

The dimensions of the new dock are as follows:—Length, 312 metres; breadth, 38 metres; depth over sill, 14.50 metres at neap tides. Dimensions of the world's largest graving docks are appended, the figures being given in metres:—

ENGLAND.		
Southampton (floating dock)	...	268 x 30.50
Portsmouth	...	281 x 31
Liverpool	...	320 x 36.50
FRANCE.		
Brest	...	250 x 36
Cherbourg	...	250 x 36
Havre	...	312 x 38
Toulon (two entrances and inside locks)	...	422 x 35
GERMANY.		
Bremerhaven	...	260 x 34.50
U.S.A.		
Esquimalt	...	350.51 x 38.09

ENGINEERS WHO HAVE CONTRIBUTED TO THE WORK.

The Contractors: Messrs. Schneider and Co., Michel Schmidt, J. and G. Hersent, their Chief Engineer, Mr. Begouen-Demeaux.

The Port of Havre Engineers: M.M. Corbeaux, Outrey, Lebourhis, Beau, Mr. Verstraten, in charge of the dredging plants of Messrs. Ackermans and Van Haaren.

CONSTRUCTIONAL DATA.

Number of workers: 900 (daily).
Volume of masonry: 324,000 cubic metres.
Weight of steel: 9,205 metric tons.
Dredged spoils: 3,250,000 cubic metres.
Horse power (tugs and floating cranes): 440-h.p.
Land machinery: 1,560-h.p.
Dredging plant (well bucket, suction and reclamation dredgers, steam hopper barges, etc.): 5,700-h.p.

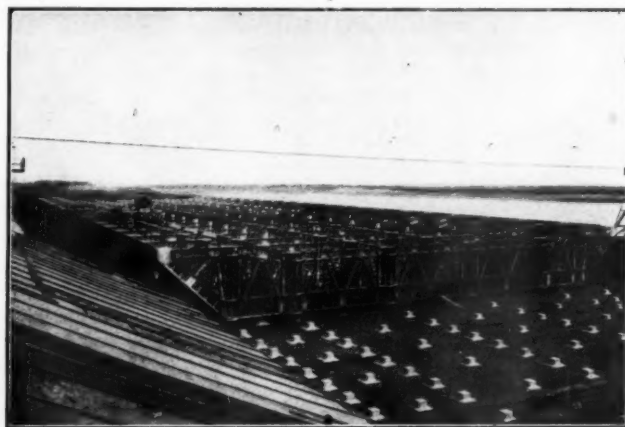
BUILDING PROCESS.

The process used has been the building of a metallic caisson, which was towed to a specially prepared berth and then sunk. Messrs. Hersent had already, in 1877, built a dry dock at Toulon (France) in a similar way, but their work in that case

was easier, as on Mediterranean shores there was no need to cope with the tide.

ERECTION OF THE METALLIC CAISSON.

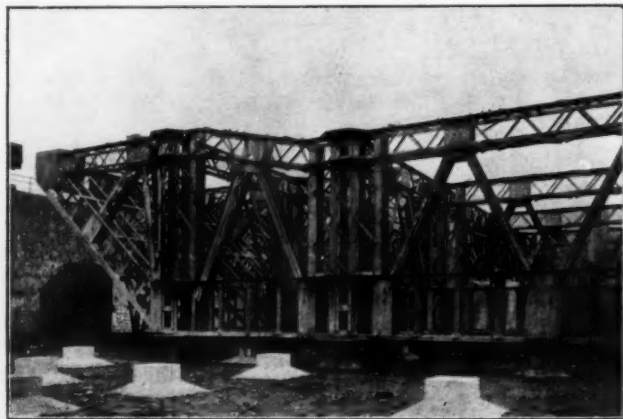
The metallic caisson for the Havre Dock was made of Martin-Siemens steel, containing very little carbon. Press riveting was the only process used for fastening the various parts to one another.



General View showing Building Slip and the Cross and Longitudinal Beams

All the beams were of the type known as Warren beams, giving no unnecessary struts, thus leaving plenty of room for handling materials. These beams are six metres high. Six lines of beams were parallel with the caisson and were connected every eighth metre by cross beams, so that the bottom of the caisson was divided into 223 cells. Communication from one side of the caisson to the other across each group of five cells, was made possible by the use of man-holes, while there existed no longitudinal thoroughfare, so that work would be carried out separately in two adjoining compartments.

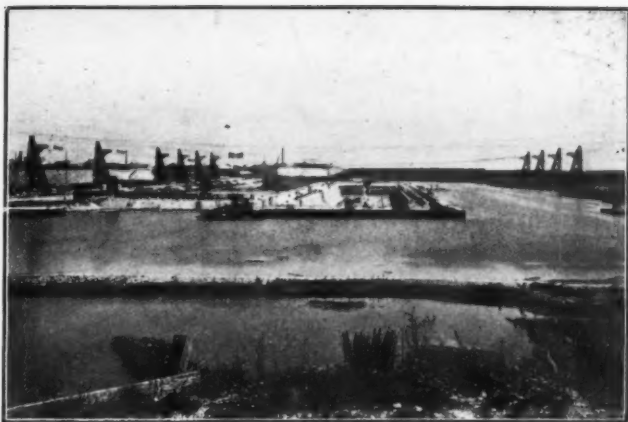
The whole net of longitudinal and cross beams acted as the keelsons and floor frames of a ship made of reinforced concrete, as concrete made with a high percentage of cement had been



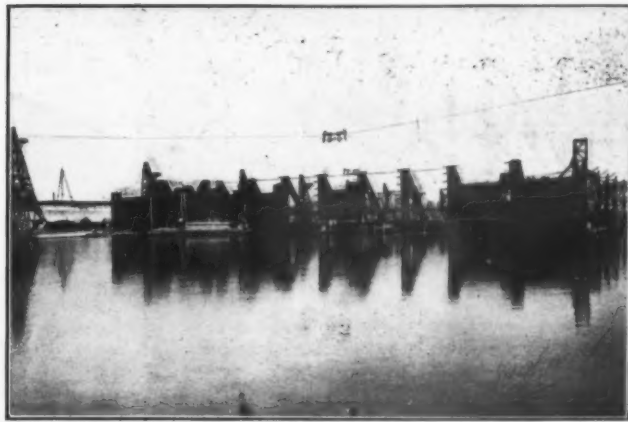
"Warren" Crossbeam resting on the Concrete Keel Blocks of the Building Slip. Former Sea Wall is seen on the left.



Building of the Water Gate Sill. Three of the Water Outlets are seen on the left.



Another View taken from the Cofferdam, showing the Cable Telfers on Cableways and the masonry work nearing completion.

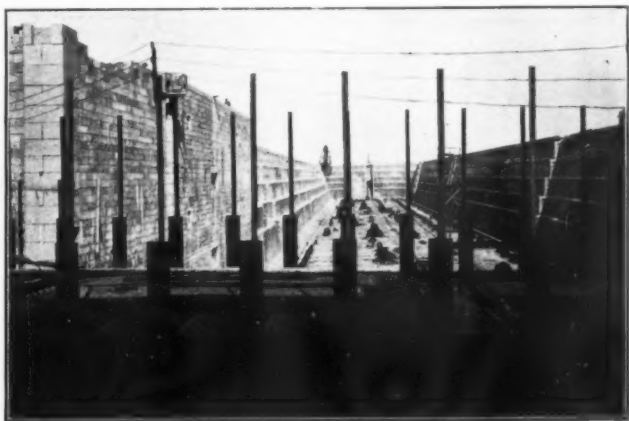


Temporary Closing of the Caisson Entrance by means of Bulkheads screwed to one another.

cast round the beams. The steel plates of the bottom of the caisson, being only 4 mm. thick, had been covered with a 38 cms. concrete mat; the concrete used for this purpose was the same as that of the beams.

The erection took place on a flat building-slip made of 742 reinforced concrete blocks set on wooden pile having to bear the total weight of 46,000 metric tons, the caisson being made of 6,000 metric tons of steel and 40,000 metric tons of concrete used for the double purpose of strengthening and preventing leakage.

The bottom blades rested on hard wood blocks, allowing some elasticity for lengthening or shrinking. Two movable telfers supplied the workmen with steel plates, bolts and rivets. The caisson was built by the Schneider and Co. Works of Chalon-sur-Saône.



The Floating Water Gate in course of erection.

FLOATING AND TOWING THE CAISSON.

The floating and the warping to the berth was necessarily regarded as an awkward job because of the great size of the caisson (the Eiffel Tower could have been laid flat into it).

Fear was entertained that after such a long rest on the building slip it would stick to the blocks.

The floating could only be done on a high spring tide, and not on a windy day; that is to say, the speed of the wind was not to exceed 20 metres per second.

The sort of dry dock made by the sea walls and the cofferdam in which the building slip was located was much too large to



Getting the Keel Blocks ready.

be filled with water within a single tide, so the sea was first let in by means of sluices up to the level of 6 metres, 30 above the zero of the Marine Charts, the depth of water required for floating the caisson being at least 7 metres 20.

On the day of the floating a gap was made in the upper part of the cofferdam by removing stone blocks so as to get the required water level within the dam; the stone blocks were afterwards set back on the sill to prevent the water from flowing out at low tide.

The warping tackle (winches and ropes) had been calculated for a maximum speed of wind of 20 metres per second, while the moorings used at the berth were strong enough to withstand a wind velocity of 35 metres per second, giving a pressure



Erection of the Upper Parts of the Frames in progress, with the Concrete already cast around the Steel Beams. Building of the Masonry Walls and Bottom is in progress.

of 150 kgs. per square metre. To make the start easier, the east end of the caisson was used as a pivot, pulling being done first at the west end. The place where it was to be sunk was outlined with piles. Floating and warping of the caisson was accomplished on August 16th, 1920, and lasted six hours, the total distance it was moved being 200 metres.

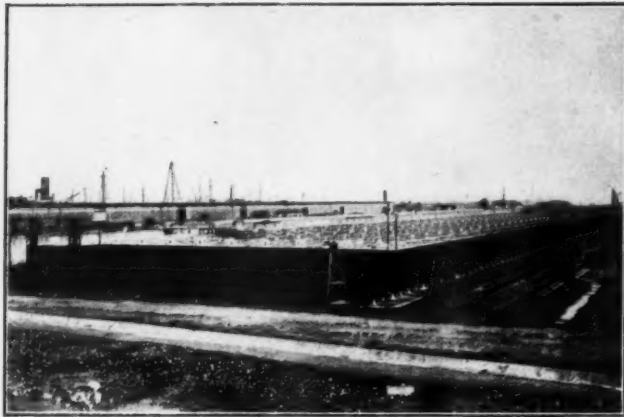
ERECTING THE UPPER PART OF THE FRAMES AND CAISSON SIDES.

The first work to be done after the caisson had been moored to its berth was to erect the upper part of the frames, the lower



The S.S. "Paris" of the "French Line" entering the Dock.

The New Havre Graving Dock.



The Caisson ready to be Floated.



Another View of Work on the Masonry.



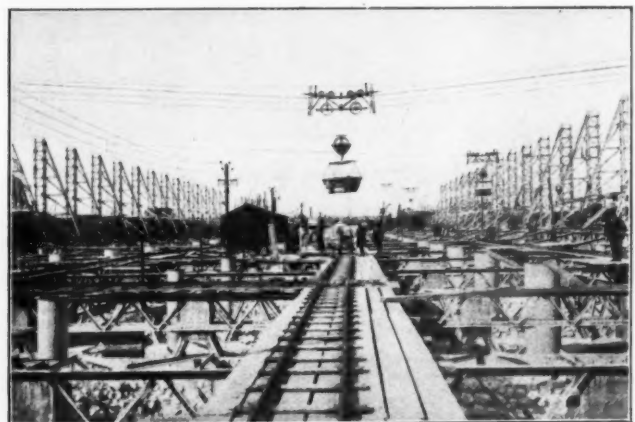
General View taken from the Cofferdam, showing the Cable Telfers. The Draught of the Caisson is steadily increasing.



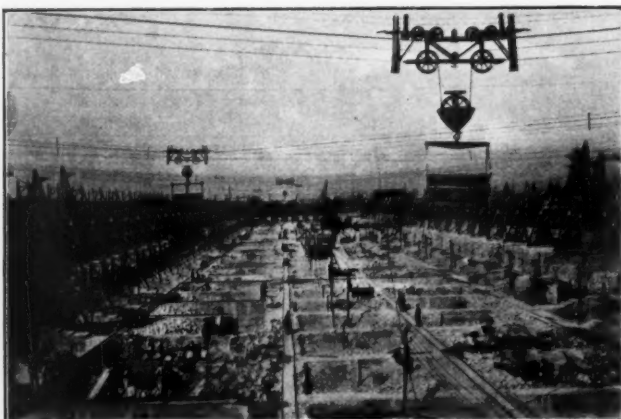
View of the Frames. The Funnels are the Entrances to the Diving Bells or Compressed Air Caissons.



The Sinking of the Caisson is about to begin.



Another View of the Frames and Diving Bell Funnels.



Masonry Work in progress.



Further Masonry Set in place.



The end of the "Warren" Beam. Concrete Keel Blocks of the Building Slip are visible in the foreground.

part of which were the warren beams situated every eighth metre.

The frames were then connected to one another, with horizontal girders on which one metre high steel plates were afterwards fastened.

The pace for raising the plates sides was the same as that for building the masonry walls, and therefore causing the draught of the caisson to increase. The entrance of the dock was temporarily closed by steel bulkheads, which could be unscrewed later on from a diving bell.

SINKING THE CAISSON.

The sinking was carried out very carefully. The bottom had to be kept horizontal and the masonry walls built in such a way that there should never be such a strain that would have made them split.

A registration of the water line was shown daily to the engineers, and, after examining the sinking plans, they could tell a day ahead in which part the work had to be carried on and therefore have the material carried there well in advance.

For calculating the various strains the caisson was considered as made of ordinary reinforced concrete beams. It should be noted that very little deformation occurred to the caisson during its sinking.

IMPORTANT PART PLAYED BY THE TELPHERS.

Nine telfers, which altogether could carry 500 cubic metres in eight hours time, brought the materials to every part of the caisson; these were built by the firm Guillerme, of Bayonne.

BEACHING THE CAISSON.

When the draught had reached 18 metres, water was pumped out of the berth till the level obtained was 2 metres 50 below L.W.O.S.T., instead of zero as before, and that in order to get an earlier beaching; which work was carried out safely,



View of the Five Rows of Keel Blocks. The Side Entrances are also visible.

though the bottom of the berth had filled with soft mud, compressed air syphons had to be used to carry it out of the diving bells, mulsifying "Jandin" tubes sending it out of the berth afterwards.

As soon as the mud was removed its place was filled with concrete, work being carried on in three diving bells at the same time. Starting with the middle one and those at the two ends so as to wedge or jam the caisson.

To avoid any lifting power from the diving bells, all of them—except the three connected to the air compressors—were filled with water, and in case the caisson would be inclined to raise, eleven sluices were ready to let water into it.

KEEL BLOCKS.

346 keel blocks made of decarbonised cast iron were fixed along five longitudinal rows (two outer, two middle and one central, numbering respectively 31, 48 and 88).

CLOSING APPLIANCE.

The dock having to be used both as wet and dry dock, has two different closing appliances: a hinged water gate of the usual type made of two non-symmetrical parts keeps the water in; while a floating gate acts the other way.



The S.S. "Paris" of the "French Line" resting on the Keel Blocks, no stays being used.

FLOATING GATE.

The floating gate, made of steel plates, was divided into two tanks by a watertight deck 1.10 metres from the bottom.

Sinking is obtained by letting extra water ballast into both upper and lower tanks, and raising by pumping water out of the lower one, the upper part emptying by gravity. The sluices of the upper tank are always kept open to get the sea level inside.

An electrically driven centrifugal turbine of 100 kilowatts can suck 400 litres per second out of the tanks. The floating gate, after it has been raised 0.75 metres above the sill, is warped by means of two hydraulic winches located on both tanks, and is guided with ropes. A wind pressure of 50 kgs. per square metre will not overturn the raised gate.

PUMPS.

The pumping plant, made by the Electro Mécanique Company, consists of ten electrically driven vertical turbines, eight of 435 h.p. each. These are able to empty the dock of a total capacity of 250,000 cubic metres within four hours and a quarter, and the two others of 120 h.p. for draining it at the rate of 1,000 cubic metres per pump and per hour.

The machinery and controls are housed in spacious chambers below the ground level at the side of the dock. The 5,000 volts alternating current is supplied by the Sté Havraise d'Energie Electrique. Each pump is fitted with a water ejector.

The new graving dock will give greater facilities for ship repairing in Havre, and thus greatly improve this ever-growing harbour.

Notes on Dockyard Electrification.

Protective Gear for A.C. Systems.

By C. H. S. TUPHOLME.

In considering the question of installing protective gear for the protection of the various apparatus employed in a dock and harbour system, where electrical energy is widely used, several important factors have to be considered. In addition, there are many protective systems for electrical circuits, and protective devices continue to be developed by the leading electrical manufacturers in this country, so that the engineer in charge should have little difficulty in selecting a system which will meet his particular needs.

Such protective systems may be roughly divided into two classes—(1), Generator and transformer protection, and (2), Feeder protection.

Overload protection will protect against most faults; it is cheap, but inherently insensitive. Its general application is for use on small branch feeders, local circuits and similar installations. On small systems, a certain amount of discrimination can be obtained by using time limits and grading these so that the switches farthest from the generators open before those closer to the machines. Overload protection is frequently used on large systems as an adjunct to other forms of protection, mainly, however, with an extremely coarse setting, as a standby in case of failure of the special protective gear. For alternators on modern systems where several machines are run in parallel, over-load protection alone may cause the whole of the machines to be disconnected one by one on the occurrence of a sudden overload on the system. For this reason the employment of overload protection alone with alternators is little used these days.

Reverse power relays function on the reversal of power in the circuit and, by closing an auxiliary circuit, open the main switch. They can be used on any circuit in which power is required to flow only one way. Their most frequent application, however, is in the case of alternators where they can be used in conjunction with almost any other form of protection. Reverse power relays will protect the machine against failure of the prime mover, failure of field or motoring. These relays can be set to operate down to about 10 per cent. reversal of power.

There are several systems of generator and transformer protection, and of these the Merz-Price circulating current generator protection will first of all be briefly considered. In this system two current transformers are inserted in each phase, one transformer being placed on the star point (usually in the generator pit), and the other at the machine terminals, or, more usually, in the switch cell. When in the latter position, the protection afforded covers the cable from the generator to the cell, as well as the machine itself. The transformer secondaries of each phase are connected in series by means of pilot wires, and the tripping relay is connected between the pilot wires. Compensating resistances are often included in the pilot circuits to ensure equal loading of the transformers and to obtain more readily a satisfactory balance.

The relay carries the vector difference of the secondary currents, which, under normal conditions, is zero. The star point of the system must be earthed. The relays will trip on the occurrence of a fault to earth in the generator or connecting cable or a fault between phases. No protection is obtained against short circuits between different turns of the same

phase winding, until they develop into an earth or short circuit between phases. Protection can be obtained with settings down to about 15 per cent. of the normal full load current.

The method is instantaneous and sensitive and can be advantageously combined with overload fuses, reverse power relays and automatic field switch.

The English electric field suppression switch is used in the exciter circuit of a turbo alternator, and operates automatically when the main oil-immersed circuit breaker is opened by its automatic protective gear, as a result of a fault in the stator windings. The field suppression switch opens the main excitation circuit without any discharge resistance, and quenches the field of the alternator in the shortest possible time, thereby preventing current being fed into the fault unnecessarily, and thus reducing the extent of the damage and the time required for, and the cost of repairs.

The Merz-Price circulating current transformer protection system is similar to that already described for generators, except that one transformer is placed in series with each phase of the primary winding of the transformer to be protected, and one in series with each phase of the secondary winding, the ratio of these transformers and their interconnection being such that their secondary currents are equal vectorially under normal conditions, neglecting the magnetising current. In order to prevent operation by the transient current when the primary is excited, "kick" fuses are generally inserted in parallel with the relay. These fuses, however, render the action of the relays less rapid. Overload fuses can be inserted in series with the pilot wires. This scheme can be applied to transformers connected in any of the usual ways or to Scott connected transformers, or it can be adapted to cover transformers in combination with generators.

The Metropolitan Vickers modification of the above scheme differs only in the arrangement of the relays. Two line fault relays are employed, each having one pole connected to different phase pilot leads; the other poles being connected together and to the third phase pilot. A leakage relay is connected between the third phase pilot and the common return pilot.

In the Beard system of self balancing generator protection, the cable from each end of each phase winding passes through a ring core upon which is wound the secondary winding connected to the relay. Normally there is no flux produced in this core, as the vector difference between the current at each end of the winding is zero. A fault in the machine between phases or to earth disturbs the balance, a secondary flux is produced and the relay is operated.

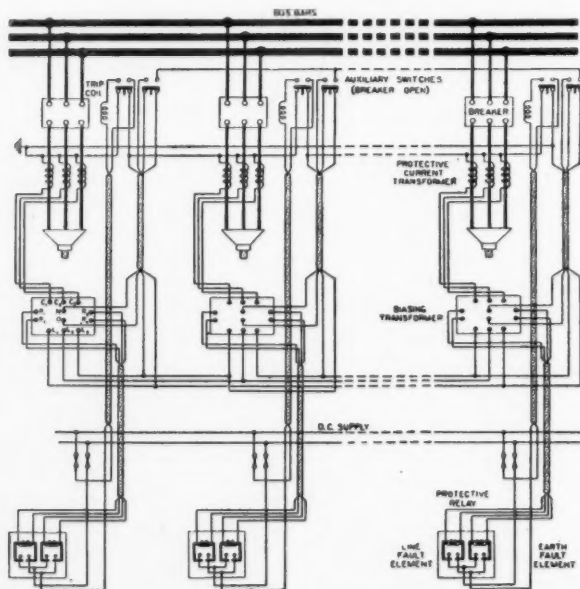
The advantage of this arrangement is that the balance is obtained in each phase by means of a single current transformer, thus eliminating the difficulties in obtaining transformers with identical characteristics, as required in the Merz-Price system. Further, the relays can be set to operate at a smaller current than the Merz-Price, thus making the device more sensitive.

The McColl biased generator protection system is on the Merz-Price circulating current principle, with a transformer at each extremity of each phase winding. The relay used, however, is a special biased relay, and consists of a restraining coil and an operating coil. The restraining coil normally carries the full circulating current which holds the tripping contacts out of engagement. The operating coil is connected between one pilot wire and a tapping on the restraining coil. A definite bias is given to the relays, which causes them to operate at an out of balance current, which is a definite percentage of the load current flowing at the time. A fault in the machine between phases or to earth ensures the excitation of the operating coil and a weakening of the restraining coil, which results in the operation of the relay. The system can be designed for reliable operation with a bias of only 3 per cent.

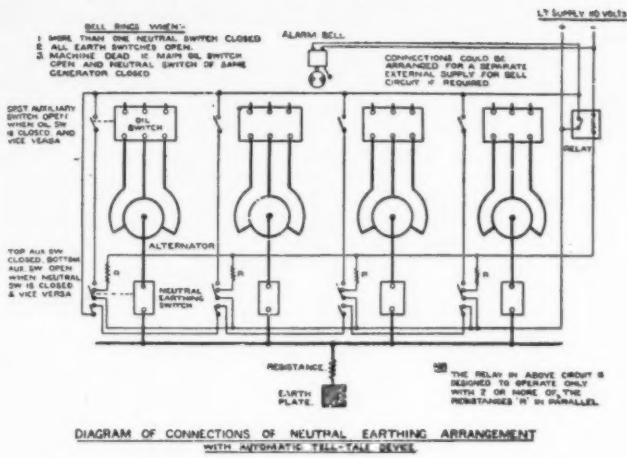
In the system of circulating current protection with electrical biasing the Merz-Price system is taken as a basis and a



English Electric Field Suppression Switch.



Parallel Feeder Protection by Balanced Current for Multiple Feeders (British Thomson-Houston).



Neutral Earthing Arrangement with Automatic Tell-tale Device (Metropolitan-Vickers).

biassing transformer is connected in such a manner that the circulating current traverses the restraining winding, the operating winding being connected between equipotential points of the circulating current system, taking the difference current between the two current transformers in each phase.

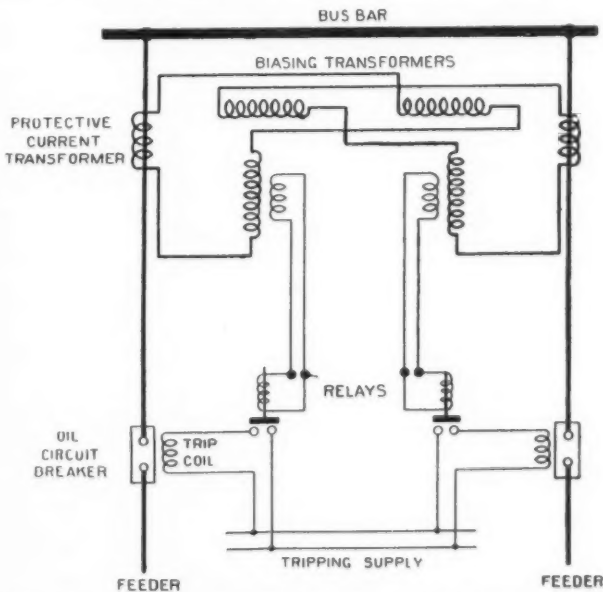
The current transformers, however carefully balanced, have, in actual practice, slight difference in their characteristics and cannot be made commercially absolutely identical. On very heavy overloads these discrepancies are magnified, and if no biasing is employed the relay settings must be high to compensate for this.

By employing the biasing transformer the current in the secondary winding is not directly proportional to the current in the operating winding, but bears a smaller ratio to it in proportion to the amount of current flowing in the restraining coil. The restraint may be arranged to be negligible until the load considerably exceeds normal and stability under short circuit conditions can be obtained together with a sensitive fault setting of the relay.

In the Merz-Price system of balanced voltage feeder protection a transformer is placed at each extremity of each phase of the feeder to be protected. The secondary windings are connected in opposition by a pilot cable, a relay at each extremity being included in the circuit. Under normal conditions there is no resultant E.M.F. in the secondary circuit, and consequently no current flows in the relays. When a fault occurs, however, the balance of the E.M.F. is disturbed and the current flows in the relay circuit, causing operation of the oil switch. The pilot wires used are generally incorporated in a multicore cable, which also serves for telephone purposes.

The Beard-Hunter compensated pilot wire system is similar to the Merz-Price balanced voltage system, but in this case a metal sheath surrounds each core of the pilot cable. The object of this sheath is to intercept the capacity current flowing from the pilot cable to earth. The sheath is divided at the centre of the cable to form two separate metallic conductors of approximately equal length, insulated from each other. Each half is connected to the protective transformer.

In the Merz-Hunter split conductor system each phase of the feeder is divided into two equal halves, which under normal conditions carry equal currents. The two halves of each phase pass in opposite directions through a ring core transformer

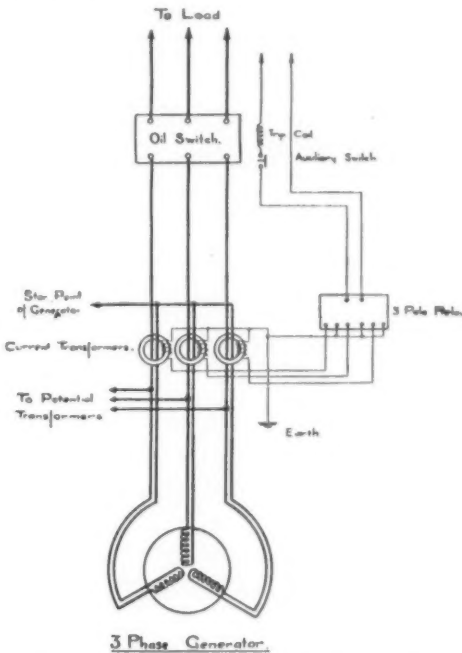


Application of Biasing Transformer with Discriminating Restraint to Parallel Feeder Protection by Balanced Current for Two Feeders (British Thomson-Houston).

situated at each end of the feeder. The secondary windings on the ring cores are connected to relays. In normal working, the current splits up equally between the two halves of the conductors, which are insulated from each other. On the occurrence of a fault, however, or a leakage, either to earth or to another phase, the current balance is disturbed and a magnetic flux is set up in the ring cores of the phase concerned, which causes a current to circulate through the relays. It is preferable to use oil switches with double contacts on one side, so as to ensure sensitivity of operation, whatever the position of the fault on the cable.

The Callender-Hunter four conductor system is a simplified form of the split conductor system, in which only one phase of a three-panel feeder is split into two equal parts. The two halves of the split phase pass in opposite directions through a ring core current transformer at each end, as in the split conductor system, and these current transformers actuate the tripping relays whenever the currents in the two splits are unequal. The conductors of all phases pass through a balancing transformer at each end of the feeder. The object of this balancing transformer is to produce unequal currents in the two halves of the split phase on the occurrence of a fault of any nature in the cable.

The McColl biased differential system resembles the Merz-Price system in that each phase has a current transformer at each end connected by pilot wires. The secondaries of these transformers, however, are connected so that the current continuously flows through the pilot wires when the circuit is in



Connections for Self-balancing Protective Gear for 3-phase Generator (Metropolitan Vickers).

use, so that any defect in the pilot wires themselves will cause the operation of the relays.

The distinguishing feature of the system is the employment of biased relays. Each relay has a restraining coil in series with the pilot wire and an operating coil is parallel, so that each current transformer has a duplicate circuit which is adjusted to have the same resistance as the pilot wire circuit. The relay is mechanically biased, to give a greater leverage to the restraining coil. The relay contacts are attached to the beam at the end bearing the operating coil.

Earth leakage protection is one of the simplest forms of feeder protection for earthed systems. A current transformer is connected in each phase of the feeder and the secondary windings are connected in parallel. A relay is connected between one of the parallel ends of the current transformers, and the other paralleled end. The current passing through the relay is the resultant of the three secondary currents, which, under normal conditions, is zero at any instant. A leakage from one line to earth the secondary current of that transformer, thus producing a resultant current through the relay.

The Glover sheathed cable system is an extension of the earth leakage system, using a special main cable. The sheath consists of a copper strip wound spirally throughout the length of the cable and connected at each end to one of the strip terminals of an earth leakage relay. The other terminal of this leakage relay is connected to one operating coil terminal of a polarised d.c. relay, the other terminal of the latter being connected to earth through a battery.

The special feature of the B.T.H. biasing transformer is electrical biasing by means of a special biasing transformer. The system can be applied to various schemes of protection, e.g., Merz-Price circulating current system for generators or transformers, the Merz-Price opposed voltage system for

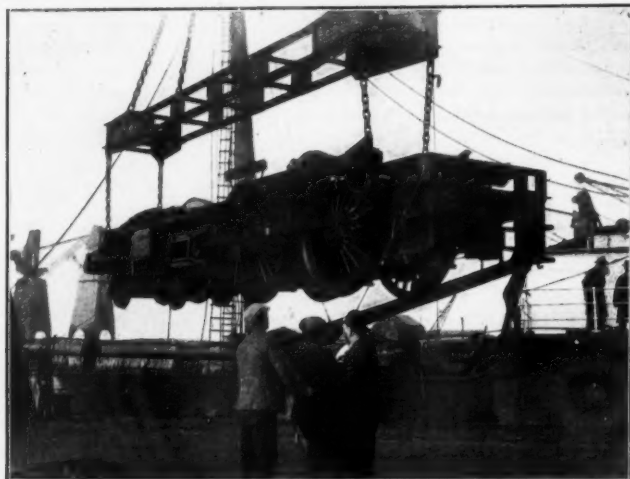
feeders, or the split conductor system for feeders. These systems, if unbiased, are liable to operate on the occurrence of severe faults outside the protected area, giving rise to large currents in the protected zone, resulting in lack of balance, capacity currents and other disturbing factors.

The writer is indebted to many of the leading electrical firms for details of their protective systems, especially the British Thomson-Houston Co., Ltd., the English Electric Co., Ltd., and Metropolitan-Vickers Electrical Co., Ltd.

Handling Giant Locomotive.

"King George V." unloaded at Cardiff Docks.

After astonishing America with a speed of 75 miles an hour, the Great Western locomotive "King George V." arrived at Cardiff Docks on November 26th.



The Under-carriage of the "King George V." being unloaded by the 70-ton Crane at Roath Dock, Cardiff.

The "King George V.," accompanied by the old broad-gauge engine "North Star," was sent to the U.S.A. a couple of months ago for the Baltimore and Ohio Exhibition, and whilst over there was given a trial run. It will be recalled that on this run the driver of the locomotive was told to drop her speed, he was then travelling at 75 miles per hour. One of the American Railway Officials, at the conclusion of the run, said that it was the smoothest run he had ever known.

The giant locomotive, which was built at Swindon, was discharged in three sections.

Weighing 135 tons, the engine and her tender were unloaded by the 70-ton crane at Roath Dock, Cardiff.

The under-carriage, weighing 57 tons with the 8-ton cradle used for the lift, was put ashore in fifteen minutes.

The illustration reproduced shows discharging operations in progress.

Launch of T.S. "Duke of Lancaster."

L.M.S. Steamer for Heysham—Belfast Service.

On November 22nd the twin-screw steamer *Duke of Lancaster*, built by Messrs. Wm. Denny and Bros., Ltd., of Dumbarton, was launched. The following are particulars of the vessel:—Length, 360 ft.; breadth, 53 ft.; depth moulded to main deck, 19 ft.

Engines are twin-screw single reduction geared turbines, of Parsons' design. Six coal fired Babcock and Wilcox water tube boilers with a working pressure of 225 lbs. to the square inch, arranged on the enclosed system. Speed 21 knots.

There will be five decks, viz.: Boat decks amidships and aft. Promenade. Poop bridge and fore-castle deck. Main deck. Lower deck.

Accommodation will be provided for sleeping 308 saloon passengers in cabins de luxe, single, double and four-berth rooms as under: Cabins de luxe, 4; single-berth rooms, 140; double-berth rooms, 66; four-berth rooms, 7; arranged on the promenade, main and lower deck amidships.

Steerage sleeping accommodation for 104 passengers will also be provided on the poop, main and lower decks.

The first-class dining saloon, to accommodate 50 persons, together with two lounges are located on the bridge deck. The smoke room is on the promenade deck and the steerage saloon and ladies' lounge is located on the main and poop deck respectively.

The carrying capacity is for 400 tons of cargo and stalls are also provided for 296 fat cattle. Portable horse stalls are also

arranged in addition to the permanent accommodation for these animals.

A special feature of the vessel is the large number of single berth rooms provided—140. Sixteen per cent. of these have communicating doors.

Special compartments are provided for the storage of mails and parcel post hampers. The hand baggage room is fitted up on the starboard side of the main saloon entrance. Ten life-boats are arranged on the boat deck amidships and aft, one of which is motor driven. The davits are of the Wolin Quadrant Overgrape pattern.

The whole of the material used in the construction of the steamer is of British manufacture.

Three steamers to the same dimensions and capacity are being built by Messrs. William Denny and Bros., Ltd., to the order of the London Midland and Scottish Railway Company, and are for use on the Company's service between Heysham and Belfast.

The launching ceremony of the first of these three vessels was performed by Lady Stamp, wife of Sir Josiah Stamp, Chairman and President of the Executive of the London Midland and Scottish Railway Company.

Gladstone Graving Dock.

Liverpool Dock again in Commission.

The s.s. *Albertic*, 18,940 tons, successfully entered the Gladstone Graving Dock on December 5th and is the first vessel to use the Graving Dock since it was placed out of commission on the 1st of March, 1921. This graving dock, which is 1,050 ft. long and 120 ft. wide at its entrance, is the largest of its kind in the world and having become an integral part of the Gladstone System of docks can be used as a wet dock if and when required.

A pumping station containing powerful machinery stands at the entrance to the graving dock. The machinery consists of five sets of centrifugal pumps with discharge pipes 54 ins. in diameter, each pump being driven direct by a vertical four-cylinder two-cycle Diesel oil engine, running ordinarily at 180 revolutions per minute, and capable of developing 1,000 horse power.

These pumps are able to empty the dock of its whole contents, amounting to about 44 million gallons of water, in 2½ hours. The *Albertic* will remain in the graving dock for four tides and will be followed in varying periods by the *Adriatic*, *Megantic*, *Celtic*, etc.

Shipping Traffic at Hamburg.

Increase in Vessels and Tonnage.

A report received by the Department of Overseas Trade from His Majesty's Consul-General at Hamburg states that shipping traffic through the Kiel Canal in October showed an increase over the previous month. Compared with the return for September some 300 more vessels with an aggregate of about 25,000 net registered tons passed through the actual figures being as follows:—

	No. of Vessels.	Net Reg. Tons.
October, 1927	5,066	2,075,982
September, 1927	4,717	2,050,472
October, 1926	4,956	2,142,493

Of the 5,066 vessels in October, 2,603 were registered as sea-going steamers and aggregated 1,868,305 net registered tons, whilst 46 vessels aggregating 45,985 net registered tons were sea-going motor ships. The above include 2,405 freight and passenger steamers aggregating 1,887,305 net registered tons, 27 fishing steamers, aggregating 2,183 net registered tons and 174 steam tugs aggregating 5,583 net registered tons.

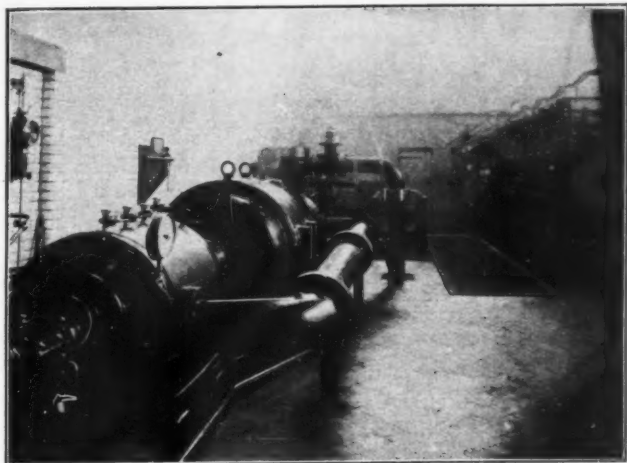
In addition there were 2,102 sailing vessels of 104,497 net registered tons and 255 lighters and barges of 57,195 net registered tons.

The vessels were loaded as follows:—

17 with Passengers.
247 with Coal.
138 with Stone.
33 with Iron.
614 with Timber
841 with Grain.
21 with Cattle.
663 Ore and other bulk goods.
1,133 with Piece Goods.
72 with General Cargoes.
1,227 with Empty or in Ballast.

Personal enquiries regarding all shipping and transport matters should be made at the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

Harbour Engineering Notes.



The Prince's Dock Power Station of the Clyde Navigation Trustees, Glasgow: Direct-driven Multi-stage Pump, with Switchboard in background.

OVERHEAD RUNWAYS.

The overhead runway system, equipped with a small electric hoist, has been proved highly efficient in many works, especially in manufacturing shops where parts are carried from one machine shop to another to undergo various processes, or for carrying completed parts to the assembly room. The capacities of these hoists has been increased during the past few years, and a recent American production is an all-steel quarter-ton electric hoist equipped with rollers for the standard runway system on I beams. This hoist is a high speed model with a pressed steel frame, chrome manganese steel in the gears and shafts, ball bearings, a non-spinning hoisting rope, oil bath lubrication, push button control and upper and lower limit switches. All the working parts are fully enclosed. The hoist weighs only 200 lbs. complete and the plain trolley type requires but 16 in. headroom.

CENTRIFUGAL BLOWERS.

The modern centrifugal blower, developed to such a high degree of efficiency during the past few years, possesses the same elemental features as the steam turbine, such as the well-known Curtis, and, whether driven by steam turbine or motor, presents all the advantages which are peculiar to the turbine system generally. There are no wearing parts other than the bearings, and these are automatically lubricated, reducing the wear to a negligible amount; comparatively light foundations are required as the moving parts are light and perfectly balanced; large temporary overloads can be carried; initial efficiency can be maintained for years without renewals or appreciable maintenance cost, and the cost of attendance and repairs is small.

The advent of the centrifugal blower has extended the limited scope to which iron and steel manufacturers were confined for the selection of a suitable blower for blast furnaces, and at the same time improved the production of pig iron. In many cases the gas engine blower operated by blast furnace gas, often a very economical source of power, has superseded the reciprocating steam blowing engine. The gas engine, however, has the disadvantage of intricate valve gear and complicated water jacketing. The large space occupied and the high initial cost are inherent defects of both the gas and steam operated blowers.

The steady blast generated by the modern turbo blower considerably improves the economical operation of blast furnaces by reducing the depth of the melting zone, whilst all the conditions of the blast tend to become more uniform, thus permitting the blast to be used at a higher temperature and pressure. The turbo blower is also capable of large temporary overloads, and when required to blow free a "hanging" furnace, the pressure of the blast can be greatly increased, and there is no risk of damage to the turbine when the blast is alternately thrown on and off.

The proportions of ore, fuel and flux in a blast furnace charge has now attained a very high degree of accuracy, and the weight of air required per minute can be very closely calculated. By means of a turbo blower this quantity of air can be constantly and automatically regulated through the medium of a constant volume governor.

Blowers of the centrifugal type consist essentially of a rotating impeller wheel, the periphery of which is surrounded by a fixed series of guide vanes constituting the diffuser, which controls the air discharges from the impeller. When an impeller and a diffuser are correctly located in a suitable casing the combination forms a single stage blower. Simple blowers without cooling devices are used where only inconsiderable pressure is required.

To obtain higher pressures, multi-stage blowers are used, consisting of several single stages connected in series and assembled in a common casing with or without cooling devices.

Low pressure blowers are designed to deliver air at pressures from $\frac{1}{2}$ to 20 lb. per sq. in. gauge, and with capacities from 1,000 to 20,000 cu. ft. of air per minute. High pressure blowers deliver air at pressures of from 20 to 40 lb. per sq. in. with capacities ranging between 5,000 and 25,000 cu. ft. of free air per minute, and are intended for such purposes as steel converter blowing. In some of our larger steel works these blowers are arranged so that they may be coupled by means of clutches to either a steam turbine or a synchronous motor, thus doubly ensuring that the supply of air will be maintained. In several of the most recent installations, the synchronous motor is connected to, say, a 1,000 K.W. circuit, and is used as a synchronous condenser for correcting the power factor.

PROTECTION OF ALUMINIUM AGAINST CORROSION.

The extending employment of aluminium in the chemical and engineering industries has led to extensive investigation into the question of protection of the metal and its alloys against those types of corrosion to which it is liable. Two methods of protection have, so far, proved successful, both employing electro-deposition. In one a film of oxide is deposited on the surface of the metal, while in the other metal coatings are deposited. Both cadmium and zinc are used with success in the electro-deposition process, the coating deposited being about five-ten thousandths of an inch in thickness. In the case of pure aluminium zinc is shown to give better protection than cadmium, though, where the equipment is constructed of aluminium alloy, there appears to be little to choose between zinc and cadmium. The oxidation process cannot, generally speaking, be applied to plant and apparatus which incorporates parts of other metals besides aluminium, though the metal deposition process forms a non-conducting coating.

ATOMIC HYDROGEN WELDING.

Atomic hydrogen welding, i.e., the process by means of which hitherto unweldable metals can be melted and fused without the slightest trace of oxidation, has been perfected by Dr. Langmuir in the research laboratory of the General Electric Company. In some cases welding can be performed on metals as thin as a sheet of ordinary writing paper. In addition, ductile welds of many special alloys, as well as iron and steel can be produced. Briefly, Dr. Langmuir's method consists in passing a stream of hydrogen through the arc between two electrodes. The heat of the arc breaks up the hydrogen molecules into atoms, and these combine again a short distance beyond the arc into molecules, and in so doing liberate an enormous quantity of heat, so that more effective welding temperatures can be obtained than with the usual welding methods. As atomic hydrogen is a powerful reducing agent, it reduces any oxides which might tend to form on the surface of the metal. Alloys containing chromium, aluminium, silicon or manganese can thus be welded without fluxes and without surface oxidation.

A NEW RUST-PROOF COATING.

A Swedish firm has developed a new coating material known as "Tillit," in which the chief ingredients are rubber and bitumen dissolved in benzole. Other ingredients are added to make it quick-drying, and to impart a hard and flexible surface. Before being dissolved in the benzole, the bitumen is subjected to an artificial oxidation, analogous to the preparation of linoleum from linseed oil, and is afterwards combined with the rubber by a special heating process. The oxidation of the bitumen removes its sulphur contents, securing durability, and the combination with rubber imparts flexibility and a high degree of adherence.



Shieldhall Dock No. 1: Dredger at Work at West End of New Dock at Glasgow.

Notes from the North.

MERSEY DOCKS ACCOUNTS.

From the Mersey Docks and Harbour Board we have received a volume of accounts covering the year ending July 1st, 1927. From this it appears that the amount received by the Board in dock tonnage rates, graving rates, gridiron rates and dock rent on vessels, and dock rates and town dues on goods was a record, the amount being £2,585,221, roughly £1,100,000 more than in 1917.

The engineer's department incurred the following expenses for general repairs and maintenance:—

	Liverpool		Birkenhead	
	£	s. d.	£	s. d.
Docks, Basins, Graving Docks, Gates, Bridges, Sheds, Streets, Electric Lighting, Gas and Water Service, etc.	169,469	17 5	56,151	0 0
Landing Stages and Approaches	15,276	14 9	3,472	16 6
Buildings, Offices, Yards, Petroleum Depots, etc., let on Rent, Police Stations, Customs Depots, etc.	6,529	4 3	4,943	13 5
Dock Yards, Workshops, Engines and Machinery, Tools, Motor Vehicles, etc.	44,764	14 3	10,285	12 0
Dredging in River adjacent to Dock Entrances, etc.	73,423	5 3	1,222	15 11
Damages done to Dock Works and Floating Plant	5,346	6 9	1,201	18 6
Dredging, Sluicing, etc.	52,910	0 5	5,921	17 8
Hydraulic Power	71,469	19 2	26,748	10 10
Sundry Works	812	19 5	61	5 5
	440,003	1 8	110,009	10 3

The expenditure on floating cranes and cranes on the quays at Liverpool and Birkenhead amounted to £39,919 13s. 8d., and the revenue £40,724 1s. 8d. Coaling appliances at Liverpool and Birkenhead involved an expenditure of £39,805 2s. 8d., and revenue £54,096 17s. 5d. It is worthy of note that the dock line of railway running from the north to the south of the port cost £9,829 in repairs and maintenance, but only yielded £2,441 10s. in tolls.

All the dock warehouses, 12 in number, yielded substantial profits amounting in all to £155,220, which, less the amount of local rates, left £94,807 nett.

LARGEST DRY DOCK IN EUROPE.

Gladstone Graving Dock, Liverpool, which was closed five and a-half years ago, pending the completion of Gladstone Dock system, was formally re-opened on November 30th. A feature of this, the largest permanent dry dock in Europe, is that it can be used, when required, as a wet dock. Its length, from the head to the inner caisson sill, is 1,050 ft. 4 in., and the width at the entrance is 120 ft. At the bottom it is 141 ft. wide, and at the top 155½ ft. wide. At high water of ordinary spring tides, the depth on the sill of the dock is about 43½ ft. The pumping machinery consists of five sets of centrifugal pumps with discharge pipes 54 in. in diameter, each pump being driven direct by a vertical 4-cylinder 2-cycle Diesel oil engine, capable of developing 1,000 h.p., the total power thus being 5,000 h.p. The dock can be emptied of its whole contents, amounting to about 44,000,000 gallons (200,000 tons of water) on a tide rising to 28 ft. above bay datum—in two and a-half hours, or at the rate of 1,300 tons per minute. A single storey shed extends the full length of the north quay.

SILTING TROUBLE.

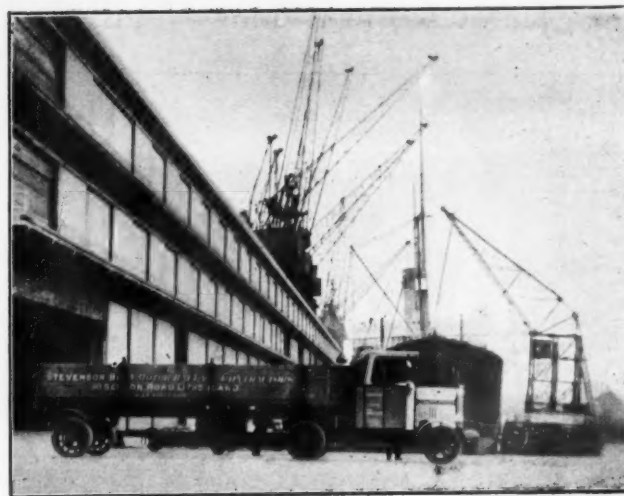
Owing to silting trouble, the original entrance to the dock (direct from the River Mersey) has been closed and replaced by another, giving absolute immunity from the costly bugbear of silting. A sea wall was built running round the north-west corner of the dock, enclosing what was formerly the original entrance. A new entrance to the graving dock was then constructed, approached from the vestibule or turning dock, as it is called, which has a water area of about 22 acres. This vestibule is large enough to permit a 1,000 ft. ship to manoeuvre into the graving dock.

TEMPORARY CLOSING OF MERSEY GOODS FERRY.

Owing to the necessity of repairs being carried out to the Woodside Ferry Floating Bridge, over which vehicles pass from the luggage boat stage to the mainland, the luggage ferry between Woodside and the Liverpool Landing Stage will be closed for a month in April or May of next year. Arrangements have been made with the Wallasey Corporation for the Birkenhead luggage steamers to convey vehicular traffic between the Liverpool Landing Stage and Seacombe Ferry while the Woodside luggage stage is closed.

PENDING IMPROVEMENTS AT FLEETWOOD.

Several meetings have taken place between the Fleetwood Dock Superintendent and the Fleetwood Fishing Vessel Owners Association and Wyre Dock Fish Merchants and Curers Association in connection with Fleetwood fish dock extensions, for which the L.M.S. are responsible and intend to spend £100,000. The association named have had an interview with the Vice-President of the L.M.S. Company (Mr. S. H. Hunt) and the Chief Goods Manager (Mr. J. Ballantyne) at Wyre Docks, to discuss details.



A Corner of the New Gladstone Graving Docks, Liverpool, showing Three-storey Shed and Cargo-handling Equipment.

NEW CANTILEVER BRIDGE FOR BIRKENHEAD.

The iron swing bridge, which spanned the 50 ft. and 30 ft. passages between the Alfred Dock and the East Float, Birkenhead, has been dismantled and temporarily replaced by a wooden bridge, to enable two locks to be widened to make one passage of 80 ft. The locks are to be eventually spanned by a single-span cantilever bridge. The task of removing the old iron bridge was executed in a week-end by a gang of about 150 men. The bridge had to be cut with oxy-acetylene burners into three parts. Each of the sections was lifted from the site by the Dock Board crane, *Mammoth*. The first of the three sections was lifted after darkness had fallen, and the work was carried on by the aid of huge acetylene and electric flares. The work of dismantling and the erection of the wooden bridge to carry the road traffic was carried out by employees of the Dock Board, under the supervision of Mr. N. F. P. Piggott and Mr. J. D. J. Saner, the resident engineers. The new single-span swing bridge will take about twelve months to build and place in position. A considerable amount of excavation work remains to be done, as the new passage is to be deepened to permit the largest cargo and passenger boats used in the Eastern trade, to pass through.

Launch of the "Binta."

New Single-screw Tank Motor Ship for Norway.

The single-screw tank motor ship *Binta*, built to the order of Mr. Per Gjerding, of Bergen, by Sir W. G. Armstrong Whitworth and Co., Ltd., was successfully launched from their Armstrong Yard recently.

The launching ceremony was gracefully performed by Mrs. E. A. Wawn.

The principal dimensions of the vessel are: Length overall, 408 ft.; length between perpendiculars, 395 ft.; breadth moulded, 54 ft. 9 in.; depth moulded to upper deck, 32 ft.

The vessel is designed to carry 8,200 tons on a mean draft of 25 ft., and her speed on trial, when loaded to this draft, will be 10½ knots. It is of the two-deck type, with poop, bridge and fore-castle, built to Lloyd's highest class, and framed on the longitudinal system.

The vessel is fitted with a raked stem and elliptical stern, and the oil cargo is carried in eight double compartments, having cargo pump room, extending from side to side of the vessel.

The captain and officers are accommodated in steel houses on the bridge and upper bridge decks, the engineers, seamen, greasers and petty officers in the poop.

Oil fuel is carried in wing bunkers at the forward end of the machinery space, in the double bottom under machinery, and also in the fore deep tank. Feed water is carried in the double bottom under the machinery. The vessel is electrically lighted throughout, and is fitted with a ½ k.w. wireless installation.

Two steam winches are fitted on the upper deck, and a warping winch on the poop. A Hele-Shaw electric hydraulic steering gear is fitted on the rudder head in the poop. The cargo oil pumps are two in number, and the vessel is fitted with a complete double oil piping system.

The vessel is also fitted with a ballast pump and oil fuel transfer pump, arranged in pump room in forehold, for dealing with the forward ballast and fuel.

The propelling machinery consists of a single-acting two-cycle six-cylinder Polar Diesel engine, fitted at the aft end of the vessel, together with one large and one small vertical boiler for the supply of steam to the auxiliaries, etc. It is being constructed by The Atlas Diesel Company and installed by the Marine Engine Department of Sir W. G. Armstrong Whitworth and Co., Ltd.

The Port of Mombasa, Kenya.

An Account of the Old Port and the Modern Harbour of Kilindini.

By **GEORGE BULKELEY, A.M.I.Mech.E.,** Port Manager, Kenya and Uganda Railways and Harbours.

HISTORICAL.

BECAUSE of its extreme antiquity as a trading post, and of its chequered international past, no description of the Port of Mombasa as it is to-day would be complete without some reference to its history.

Adventurers from Southern Arabia, seeking the "Gold of Havilah" for King Solomon from the ancient gold workings near the Zambesi, would have explored the East African Coast. It is certain that they knew Zanzibar and the coast tributary to it some two thousand years back, and that from them the Greek geographers derived their knowledge of the district.

Herodotus states that, in 600 B.C., a Phoenician fleet was despatched by Necho, King of Egypt, and circumnavigated the continent of Africa; passing, no doubt, through the ancient Suez Canal, which was constructed by Seti I. of Egypt in the year B.C. 1340, and cleared out and renovated by Omar in B.C. 640.

So far as later history is concerned, Mombasa is mentioned several times prior to its re-discovery by Vasco da Gama on his way to India at the close of the fifteenth century. Such dates are A.D. 60 and 956, and again in 1331 when the Arab explorer Sheik Batula visited it. A conical coral mosque tower of considerable antiquity still stands on the cliff of M'Baraki at the entrance to what is known as Kilindini Harbour—16th century, is in good preservation and is used as a prison. Mombasa has always been a shipping centre. Writing in the year 1512, Quarta Barbosa thus describes it: "Mombasa is a City of the Moors, very large and beautiful, and built of high and handsome houses of stone and whitewash, and with very good streets. It is a town of a great trade in goods and has a good port where there are many ships, both of these which sail for Sofala, and those that come from Cambay and Malindi, and others which sail to the islands of Zanzibar, Maufia and Penda."

The local name for Mombasa is "Kisiwa cha M'Vita," "The Island of War," for a succession of assaults and bombardments, followed usually by the sacking of the city, were experienced through the 16th, 17th and 18th centuries of the Christian era. About A.D. 900, the Persian Arabs began in earnest to colonize the East African Coast and Islands, and by the close of the twelfth century had founded a series of sultanates there. Following Vasco da Gama's visit, the Portuguese occupied the island by force on not less than six occasions; first in A.D. 1505; then again in 1528, 1587, 1589, 1632 and 1727. They also attacked it unsuccessfully in 1699,

1703 and 1710. Between these dates of European aggression, the island was occupied by the Turks in 1585 and 1588; by the Wazumba cannibals in 1589; and, lastly, by its original conquerors, the Amani Arabs, who captured the fort, after a 33



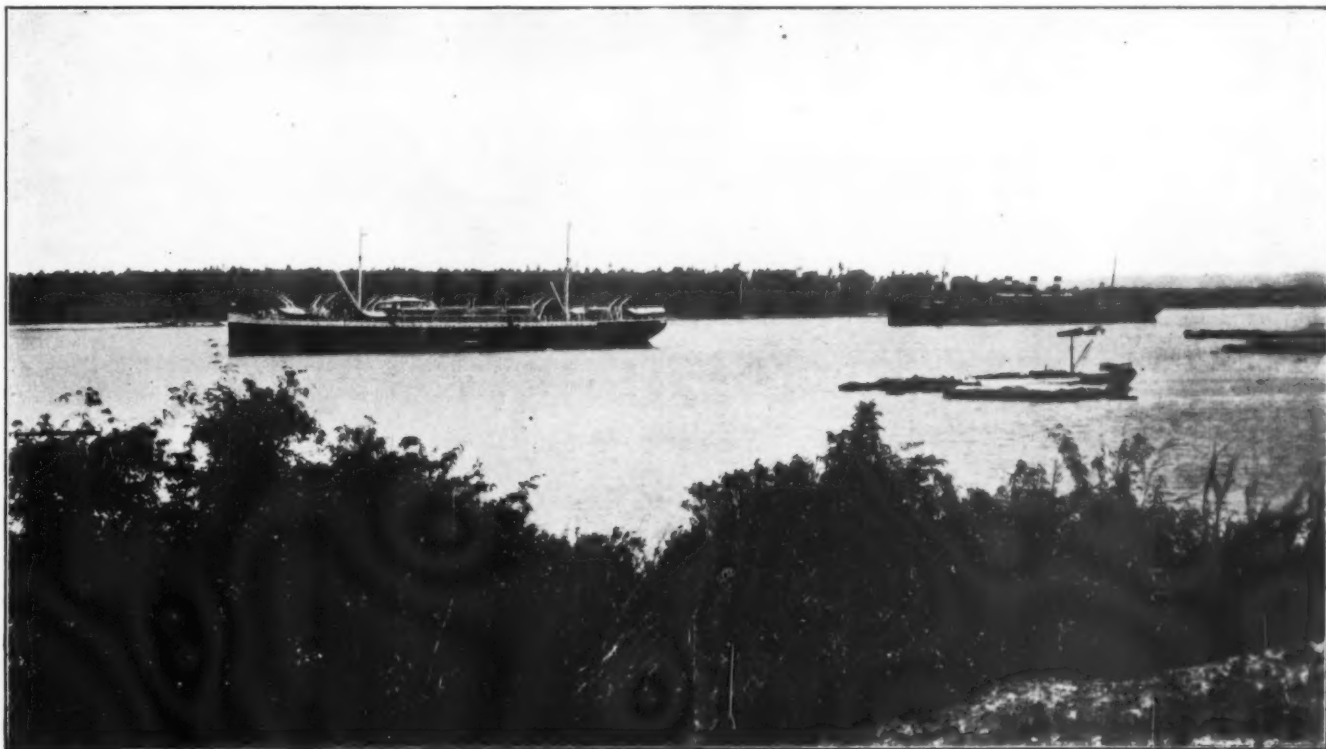
Photo

The Old Port of Mombasa.

[W. D. Young.

months' siege, in 1698. Mombasa then continued under Arab rule as a trading depot for ivory and slaves for nearly two hundred years.

In 1824 it was provisionally annexed by Great Britain after the local Sultan had, on his own authority, hoisted the British flag to protect himself from the Sultan of Zanzibar. This annexation was, however, disavowed by the British Government, and Arab rule still prevailed at Mombasa, which became tributary to the Sultan of Zanzibar, until 1887 when Mackinnon obtained, in return for a definite annual payment, a concession of that potentate's possessions along the East African mainland coast. Mackinnon then formed a trading association which, in 1887, received its first charter as the Imperial British East Africa Company. In 1896, this company transferred the whole of its properties and trading rights to the Government of Great Britain, receiving a Parliamentary grant in return.

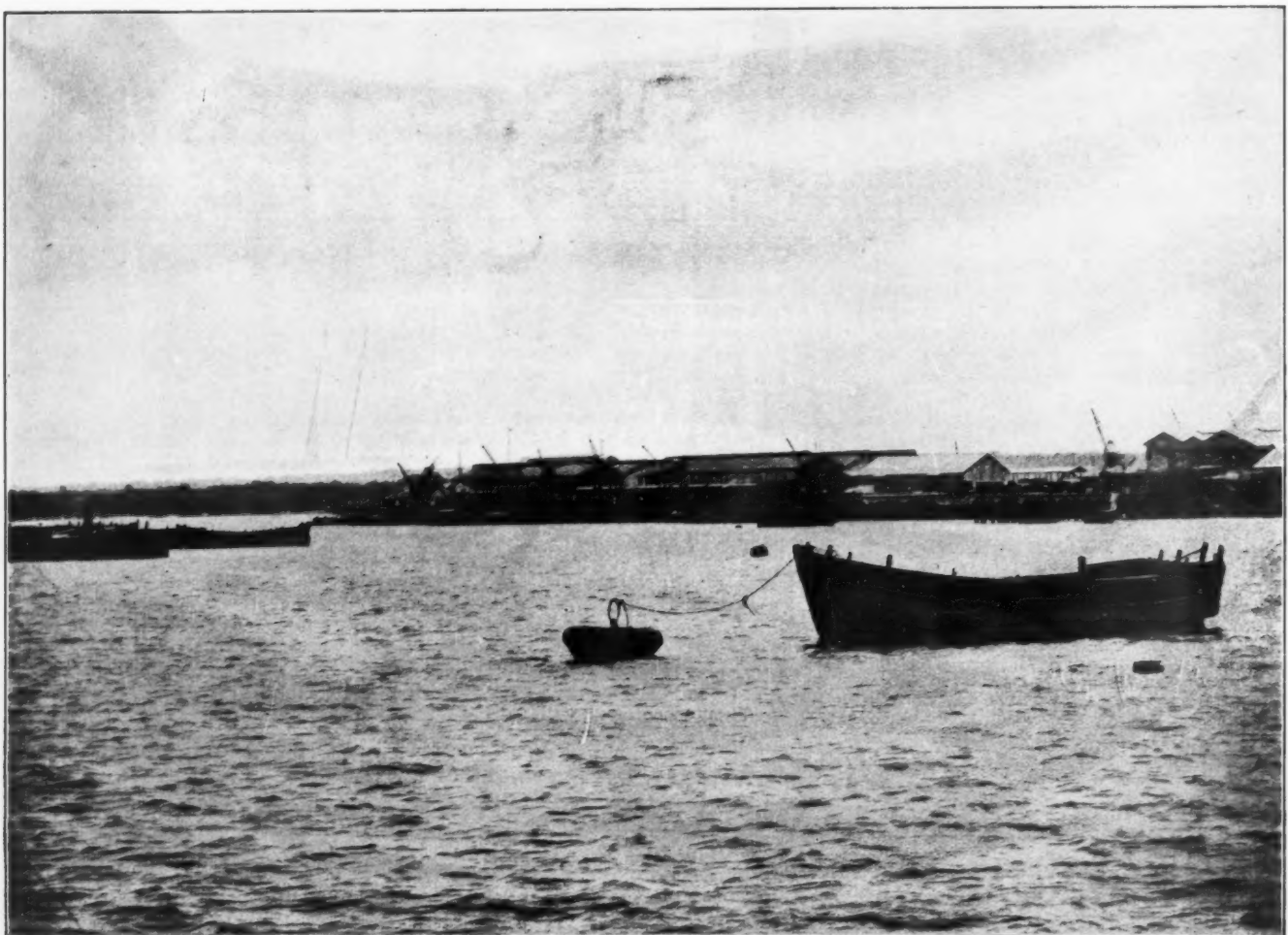


Shipping in the Stream at Kilindini Harbour.

The Port of Kilindini.



Kilindini Harbour, Mombasa Island, viewed from the Mainland behind the Railway Bridge.



Lighterage Quay and Transit Sheds at the present day.

To Sir William Mackinnon, first of all, Mombasa owes its present trading and shipping position under the British Crown, and his statue stands in its city square as a lasting memorial to him; as is the spacious Anglican Cathedral to Bishop Tucker who, in conjunction with Sir William Mackinnon, was instrumental towards maintaining Uganda under the East Africa Company until it became a British Protectorate.

THE RAILWAY.

The factor which has secured for future generations Mombasa's position as a leading African port, is the Kenya and Uganda Railway. The first report as to the feasibility and direction of such a railway was made by two distinguished English Engineers at the instance of Sir William Mackinnon's Chartered Company, but the survey and construction were carried out by the British Government after acquiring the rights of that company—the work of construction being commenced in 1898. At first, material, equipment, staff, and food, were landed on the beach at Ras Kilindini direct from lighters, which consisted of dismantled dhows. A jetty was then built and, eventually, the landing place at Kilindini took the form of a small area of water encircled by two curved piers, on which were mounted steam cranes for dealing with the lighters. The lighterage quay was later extended and more quay cranes added. It now appears as illustrated. For many years the whole of the trade of Kenya and Uganda passed over this quay and it is still in daily use in connection with cargo lightered to and from vessels lying in the stream. In 1898, the total volume of import, export and re-export trade was valued at £370,273. The corresponding value for the year 1925 was £22,228,380.

THE TWO HARBOURS.

As far back as 1910 it became evident that a scheme of deep water berths at Mombasa would soon be necessary, alongside which ocean-going shipping could berth, and be discharged and loaded by modern machinery to and from sufficiently commodious and well-equipped transit sheds.

As will be seen from the sketch map of Mombasa Island on the Supplement, there are two harbours, i.e., that of the Old Port and that of Kilindini. Up to comparatively recent years some steamships anchored at the Old Port, which, however, is now confined to coasting steamships and the dhow trade. This last-named comprises both the small coastal dhows and also the large dhows which cross over from the Persian Gulf, arriving on the N.E. Monsoon, and returning on the S.W. Monsoon.

The initial investigations into the development of the port resulted in a decision to concentrate at Kilindini Harbour a line of deep-water quay, with transit sheds and mechanical equipment. In this connection it is interesting to note that the name Kilindini signifies "Beside the Deep Place," the water deepening at once to 100 ft. and over, and the whole water area being suitable for shipping of any size and draft.

In 1912 Messrs. Coode, Fitzmaurice, Wilson and Mitchell were asked by the British Government to prepare a lay-out in consultation with those connected with the Port of Mombasa, and this was done. The recent war, however, set back the proposed development, but in 1921 a contract was placed with Messrs. Pauling and Company, Limited, for the construction of Nos. 1 and 2 deep water quay berths, with a double-storey transit shed alongside each, and to make the necessary preparation for a further extension of the deep water quay thus commenced; the Resident Engineer for the work being Mr. F. C. Fforde, M.Inst.C.E., on behalf of Messrs. Coode, Fitzmaurice, Wilson and Mitchell.

THE NEW DEEP WATER BERTHS.

In August, 1926, this contract was completed and illustration shows Berths Nos. 1 and 2, with their corresponding transit sheds, together with the preliminary provision made for the quay extension. A further contract was placed with Messrs. Pauling and Co. in November, 1926, for the construction of two additional deep water quay berths, Nos. 3 and 4, with transit sheds alongside, and this work is now in progress under Mr. Fforde's supervision.

The scheme aims at a continuous deep water quay to accommodate seven large passenger and general cargo ships alongside, together with special additional arrangements for dealing with oil and coal in bulk and for bunkering. Owing to the large water area available for port purposes, there is, however, no practical limitation to the number of deep water quay berths which can be constructed as and when the trade of the port requires these, and schemes for the ultimate complete development of the port are under consideration. The upper illustration on page 82 gives some idea of the extent of Kilindini Harbour, which is shown viewed from the westward mainland and in which the first two deep water quay berths and transit sheds can be distinguished. This photograph is worth looking at through a magnifying glass, when the general proportions of the harbour become apparent.

DETAILS OF THE WORKS.

The new works comprise the following:—

A.—1,110 lineal feet of quay wall with 33 ft. of water alongside at L.W.O.S.T., of which 958 lineal feet are now in actual

use for the berthing of ships and 152 lineal feet are temporarily in the occupation of Messrs. Pauling and Co., Ltd., to provide the necessary working room for them to proceed with the 1,000 ft. extension of the quay included in their new contract. In addition to the above there are 100 lineal feet of quay wall at the south end over which the depth of water varies from 33 ft. to nil at L.W.O.S.T. This length contains a flight of boat steps.

The quay space along this wall is 53 ft. wide between the coping and the transit sheds; this space is equipped with three metre-gauge railway tracks and necessary fittings for same, one crane road 15 ft. gauge for the quay cranes, which consist of eight electric three-ton quay portal cranes with level luffing jibs, each capable of lifting 3 tons at a radius of 52 ft. at a speed of 100 ft. per minute, or 25 cwt. at the same radius at a speed of 250 ft. per minute. Two similar cranes of 5-ton capacity are on order as additional quay equipment. The quay space is lighted at night by electric lights fixed along the front of each transit shed.

B.—Two double-storey transit sheds each 414 ft. long by 120 ft. wide.

On the landward side each shed is provided with a railway track inside the shed as near as possible to the wall to serve the ground floor, which is graded up from the seaward side so as to coincide with truck floor level on the landward side. There is also a platform 11 ft. wide with railway alongside outside each shed to serve the upper floor, export cargo being unloaded on to this platform and hoisted to the first floor by means of the 1-ton electric cranes installed in the upper storey. This platform and railway track are also used to start boat and mail trains from in connection with ships' arrivals at the port.

The upper storey of each shed is equipped with:—

- (a) One-ton type electric underhung travelling jib cranes which travel transversely across the sheds and are capable of lifting one ton at a speed of 150 ft. per minute and travelling across the shed with load at a speed of 200 ft. per minute. Four of these cranes were supplied by the Vaughan Crane Co., of Manchester, and four by Ransome and Rapier, of Ipswich.
- (b) One-ton type electric fixed bracket cranes capable of lifting one ton at a speed of 150 ft. per minute. Five of these cranes are by Samuel Butler and Co., Leeds, and five by Joseph Booth and Bros., Rodley, Leeds.

The upper storey of each transit shed is capable of accommodating 5,000 deadweight tons and the ground floor 10,000 tons of 40 cub. ft., and four hatchways have been provided in the top floor to facilitate the transfer of goods between the ground floor and top floor, or vice-versa, as may be required.

Both floors of each shed are well provided with electric lighting for night work.

C.—A stacking ground is provided behind each shed 414 ft. long by 166 ft. wide for ironwork and such import cargo as cannot be dealt with in the sheds.

These two stacking grounds are equipped with one 10-ton travelling portal crane 30 ft. radius and one 5-ton travelling portal crane 50 ft. radius; both are by the Wellman Smith Owen Engineering Corporation, Ltd.

The gauge of the crane road is 15 ft., the same as that for the quay cranes, there being a separate road for each crane, one on the landward and one on the seaward side of the area. The total width of 160 ft. is swept by the jibs of these two cranes. This area is lit by electric lights on standards for night work.

D.—Railway lines and sidings to serve the quay, transit sheds, and stacking grounds. The quay rail tracks are being laid down so as to allow the quay opposite each ship alongside being shunted without interference with the quay lines opposite any other ship.

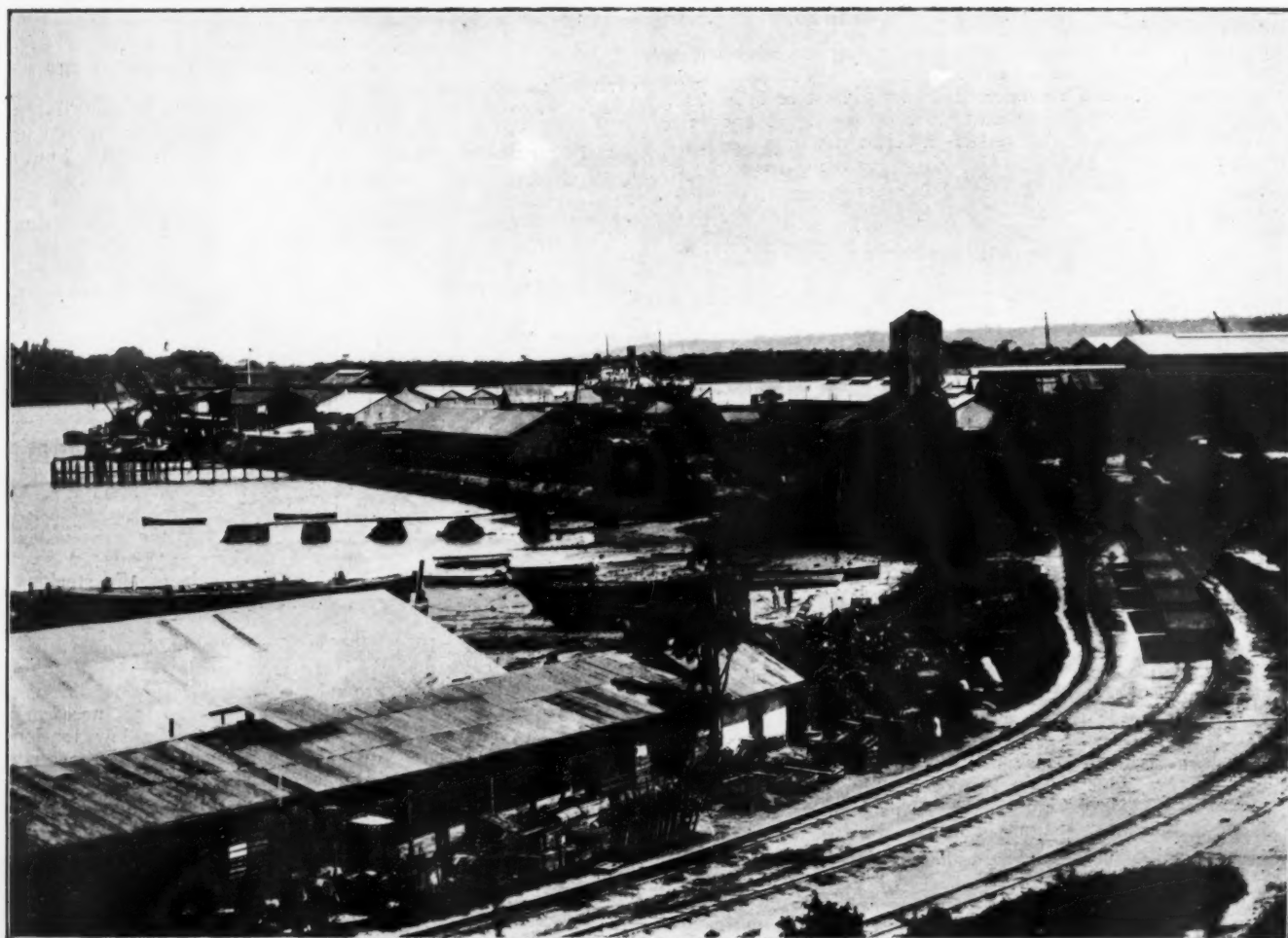
E.—Macadamised roads to give access to the quay, transit sheds and stacking grounds have been provided. These comprise roadways 80 ft. wide at the south end of Shed No. 1, between Sheds Nos. 1 and 2, and at the north end of Shed No. 2. A road 25 ft. wide parallel to and at the back of the sheds along the west side of the stacking grounds; a road 40 ft. wide parallel to and on the east side of the stacking grounds, and an approach road at the entrance to the new works area.

F.—The electrical installation for the supply of electric power to the quay and shed cranes, also electric lighting on the quay and stacking ground areas and inside the transit sheds consists of a sub-station containing the necessary transformers and switchboards, from which the low tension cables are led to the quay and transit sheds. For the quay cranes these cables are laid in a concrete trench formed on top of the quay wall just behind the coping in which plug boxes are provided at 50 ft. intervals. Concrete trenches have also been provided for the cables feeding the stacking ground cranes in which plug boxes are fixed at 100 ft. An electrical mechanic's workshop has also been provided adjoining the sub-station, to which it is proposed to add additional bays, so as to form a comprehensive fitting and machine tool workshop in which the mechanical maintenance of all port machinery can be carried out.

The Port of Kilindini.

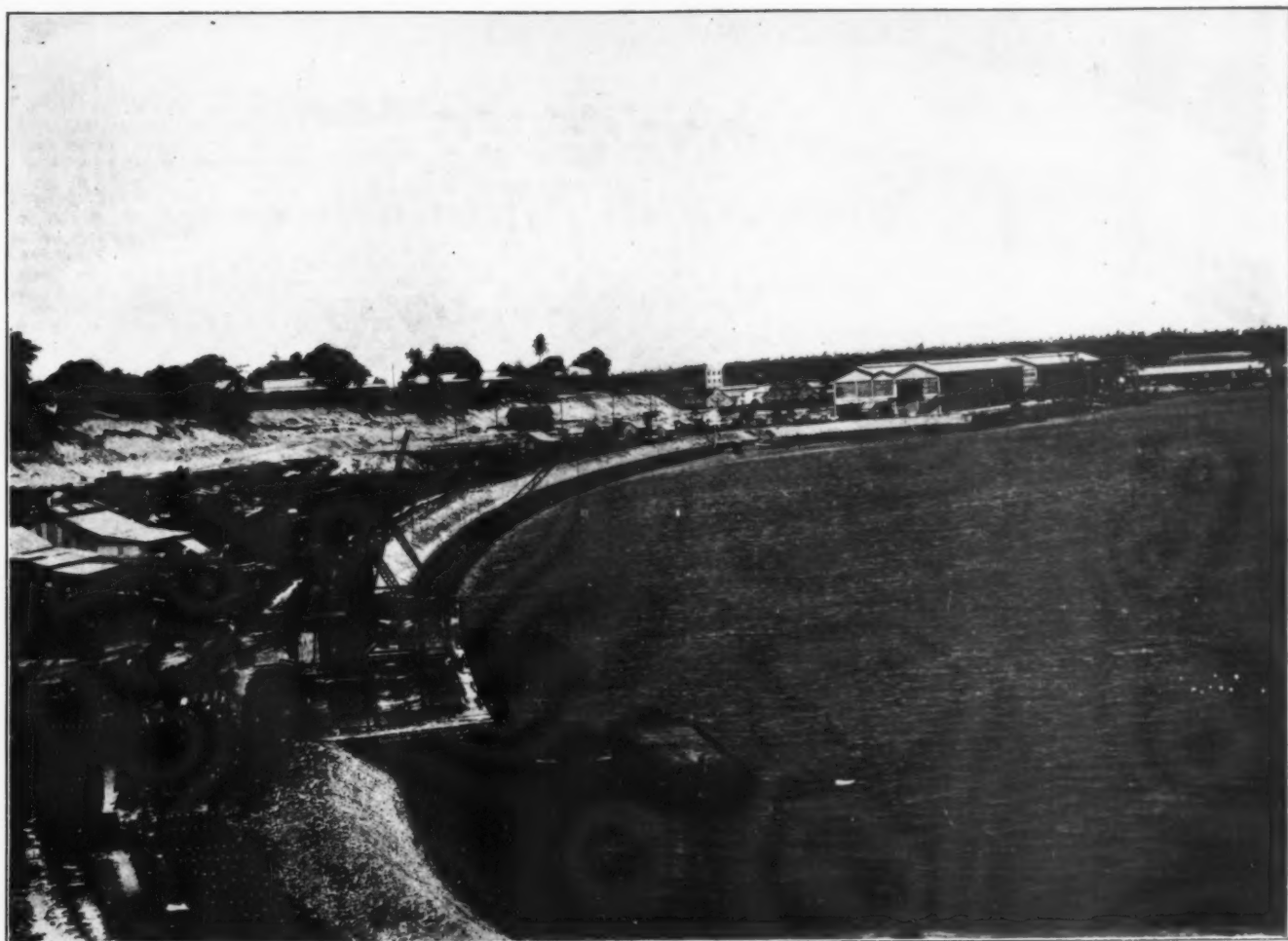


Kenya and Uganda Railway, Kilindini Pier, Old and New Wharves, 1928.



View of Kilindini Pier, Mombasa Island, in 1928.

The Port of Kilindini.

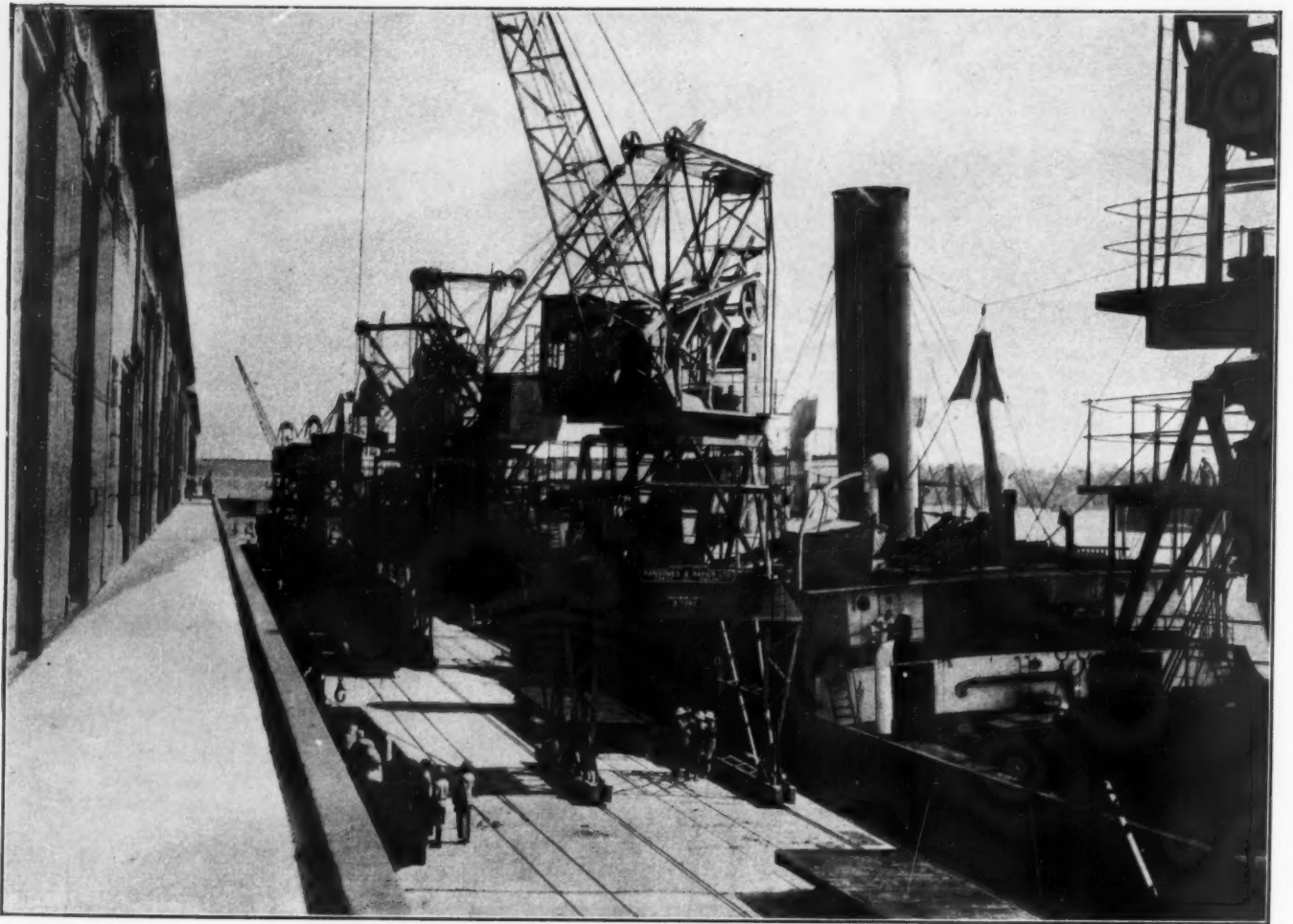


Nos. 1 and 2 Deepwater Quay Berths and Transit Sheds, showing preparations for Quay Extension.



Berths Nos. 1 and 2, Deepwater Quay, Kilindini Harbour.

The Port of Kilindini.



Berths Nos. 1 and 2, Deepwater Quay, Kilindini Harbour, with Two Ships working alongside.



The First Vessel (S.S. "Reitfontein") to discharge General Cargo at the new Deepwater Wharf, Kilindini.

RESIDENT ENGINEER;—MR F.C.FFORDE, M. INST. C.E..



NT TO THE DOCK AND HARBOUR AUTHO

HARBOUR WORKS.

B A S A .

IT SHED ACCOMMODATION.

—MR F.C.FFORDE, M. Inst. C.E..

SCALE FOR PLAN.

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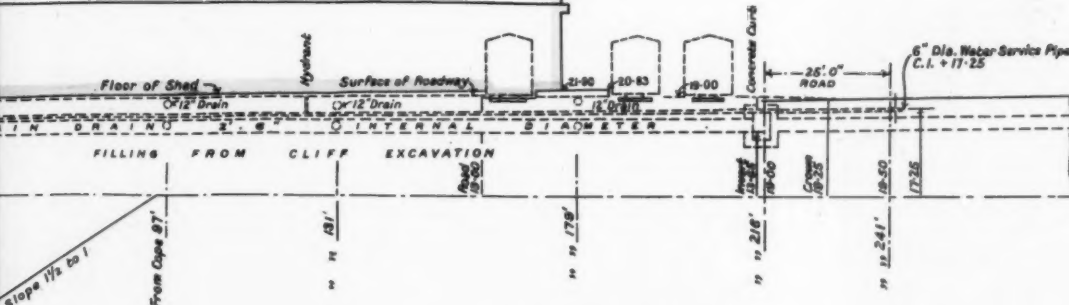
CRANE TRACK

I N I H A R B O U R

NOTE:—New Works are coloured RED.



DOUBLE STOREY TRANSIT SHED
414' LONG X 120' WIDE

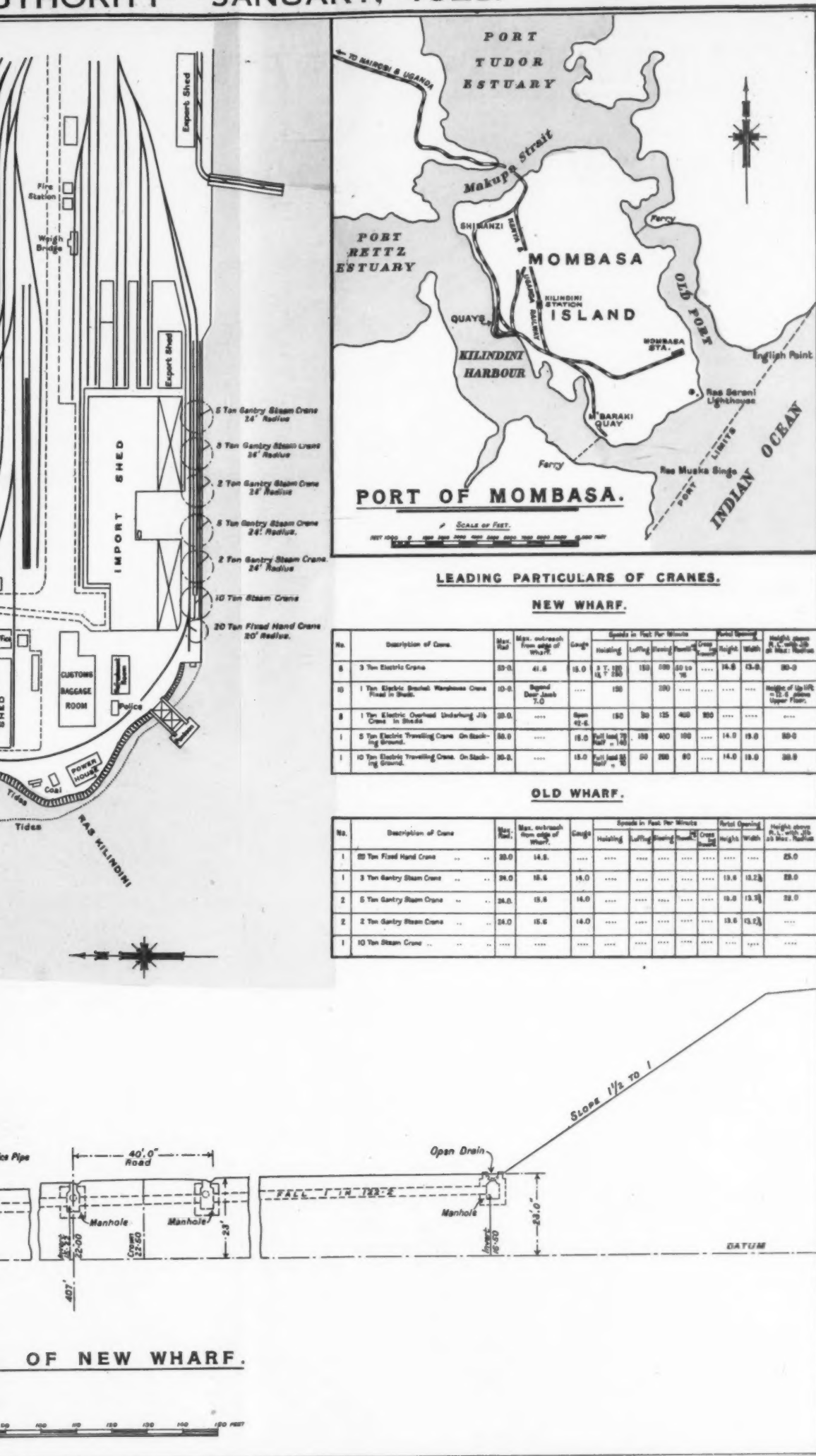


TYPICAL CROSS SECTION OF

SCALE FOR CROSS SECTION.

FEET 0 10 20 30 40 50 60 70 80 90 100

WARD & FOXLOW, Harcourt St, Marylebone, W.1. 5044.



KILINDINI HARBOUR

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A contract for the supply of electrical current for power and lighting was entered into by the administration with the East African Power and Lighting Co., Ltd., and is now completed. The power is supplied from this company's Diesel-engined power station at Shimaazi, and is delivered by high tension wires on poles above ground to the sub-station, the low tension cables from the sub-station being placed underground and in trenches, as described above.

G.—The water supply is taken from the Mombasa water mains with fire hydrants along the rear of the transit sheds and along their top storey verandahs. Hydrants are also installed at convenient intervals along the quay wall immediately behind the coping to both supply fresh water to ships and for use in case of fire.

H.—A complete drainage system is provided to collect and lead away the surface water which, during periods of heavy rains, is considerable.

The total area of ground covered by the new quay transit sheds, stacking grounds and roads is about 13 acres, but in addition to these another 27 acres of level ground have been formed partly by excavating and partly by reclaiming from the sea. This area is at present in the hands of the contractors as a yard in connection with their contract for the extension of the deep water quay. The new quay berths Nos. 3 and 4 will be fully equipped with electric level-luffing jib cranes, while the new transit sheds are also to be provided with electrically-operated mechanical equipment to facilitate the rapid handling of cargo.

The plan on Supplement comprises the old lighterage quay, together with the completed deep water quay berths and the direction of their present extension. A typical cross-section through the deep water quay wall and transit sheds is also shown.

TRADE AT THE BERTHS.

The following table shows the use made of the two completed deep water quay berths since they were brought into general use for working general cargo on August 29th, 1926:

First column gives figures for those berthed alongside quay and the second those anchored in the stream.

AUGUST 29th, 1926, to JULY 31st, 1927.

Bill of lading tonnage of general cargo discharged from ships	105,637	56,335
Bill of lading tonnage of general cargo loaded into ships	107,727	87,574
Number of ships arriving in the port	104	305
Total registered tonnage of ships arriving in the port	426,380	1,013,501

It will be seen from the above that the percentage of ships which were accommodated alongside the two available quay berths was 25.43 per cent. of the total ships arriving in the port between the dates named; the corresponding percentage of their total registered tonnage being 29.61 per cent.

The Steamship Companies which are now regularly calling at the Port of Mombasa are as follows:—

British India Steam Navigation Co., Ltd.; Clan Line; Compagnie Africaine de Navigation; Compagnia Italiana Transatlantica; Deutsche Ost Afrika Linie; Ellerman Lines; Harrison Line; Holland Est Afrika Lijn; Messageries Maritimes; Nippon Yusen Kaisha; Osaka Shosen Kaisha; Union-Castle Mail Steamship Company, Ltd.

The United States Shipping Board expect to arrange calls in the near future.

TOURIST TRAFFIC.

The historical associations of Mombasa, and the interest and scenery of the Kenya Highlands, with their phenomenal agricultural development, are proving of increasing attraction to tourists (apart from those who make a longer stay in the country for the well-known big game shooting and other sport attractions). April of this year saw the arrival of the Cunard liner *Franconia* with some 400 tourists aboard. The *Franconia* was berthed alongside the deep water quay at early morning and her passengers enjoyed the day ashore on Mombasa Island, the vessel sailing at dusk. No less than six large liners carrying tourists are scheduled to call at Mombasa during 1928.

The illustration on page 81 shows a part of Kilindini Harbour with the British India ss. *Taklinea* and the Messageries Maritimes ss. *Leconte de Lisle* at anchor in the stream.

The railways and harbours of Kenya and Uganda are all Government-owned and operated. The control of the Port of Mombasa (including the small sea coast ports of Kenya) is exercised by Sir Edward Grigg, K.C.V.O., C.M.G., D.S.O., M.C., High Commissioner of Transport for Kenya and Uganda through the Hon. C. L. N. Felling, C.M.G., General Manager of the Kenya and Uganda Railways and Harbours; of which administration the port department is in charge of the Port Manager, at Mombasa, who exercises jurisdiction ashore and afloat and reports direct to the General Manager, whose offices are at the capital Nairobi. The High Commissioner of Transport is further advised by a Port Advisory Board, which sits in Mombasa and is representative of Kenya and Uganda commercial and shipping industries. The Chairman of the Board is Hon.

G. Walsh, Commissioner of Customs, and the General Manager and Port Manager are entitled to attend its meetings. The whole of the working within the port land and water areas is controlled by the Port Department; that is to say, shipping and rail movements, transit shed working, the operation of mechanical appliances and their maintenance; together with the conduct of the port's business affairs.

New Grain Silos at Marseilles.

The British Consul-General at Marseilles has forwarded to the Department of Overseas Trade a brochure issued by the "Compagnie des Docks et Entrepôts de Marseille," regarding their recently-built silos for the handling of grain at that port, which may be consulted upon application to the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

It is understood that the silos commenced work on the 15th September last and the following information extracted from the above-mentioned booklet may be of interest: With the completion of the present silo building, the Port of Marseilles would now appear to be provided with the most up-to-date plant both for the handling and storage of grain, with the one important exception that suction plant for the rapid discharge and transfer of grain in bulk from ships hold to silos is lacking. It is gathered from the report that the necessary provision has been made for the installation of a suction plant, but that no actual decision has as yet been come to as to putting the work in hand, the authorities concerned having decided to leave this question over until experience shall have been acquired as to the sufficiency of the present machinery in the handling of grain.

HANDLING SYSTEM.

With the present equipment importers will no longer need, as formerly, to provide bags for their grain and they will be spared the expense involved as also losses suffered hitherto through delays on the quays and consequent deterioration of their grain. By mechanically propelled belting and "Poulsom" grabs the grain can now be discharged in bulk, transferred to the silos to remain in deposit or be immediately transferred to lorries and carts. Where packing into sacks is required, this is effected mechanically, ample plant existing for the purpose.

The ground floor of the building is reserved for means of access, both by road and rail, being connected, for the latter with the P.L.M. system.

The first floor contains the machinery for packing into sacks and weighing. The grain is transferred from here to the trucks, lorries and carts below by means of grain shoots, of which twenty-three have been installed. Office space is also provided, on this floor, for the use of clients.

On the second floor are the silos themselves, consisting firstly of a series of 57 separate cylindrical cells of 420 cub. metres capacity and capable of storing, each, 325 tons of grain. Secondly, between these large cylindrical deposits, the intervening space is utilised for the construction of 42 small cells of 110 cub. metres capacity and able to store, each, 90 tons of grain. The total capacity of these silos, or air-tight pits, is about 22,000 tons.

On the third floor are installed the belt distributors for transporting the grain to the different cells.

On the north portion of the building is the loading tower, where are the grain lifts, the automatic weighing scales as also the signalling and other machinery for the directing of operations throughout the building.

DISCHARGING FROM SHIPS' HOLDS.

In the absence of suction plant, cereals are discharged from ships' holds by means of grabs of the type known "Poulsoms." Each grab can manipulate from 60 to 70 tons per hour and, as two grabs can work at one time in each hold, the average quantity of cereals which can be discharged exceeds 100 tons per hour. All the work as between ship and silo plant is now effected by machinery, whether the grain is handled in bulk or mechanically packed into sacks. The machinery in the building has been designed for the manipulation of 150 tons of grain per hour, so as to be in a position to work with sufficient rapidity to deal with the output of suction plant, should this latter be eventually installed.

A "Schopper" machine has been installed for gauging the specific gravity of grain.

The Compagnie des Docks et Entrepôts de Marseille have recently issued an up-to-date plan of the port of Marseilles in colours, which may be purchased at 60 francs each.

Personal enquiries regarding all shipping and transport matters should be made at the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

ELECTRIC LIFTS.

"Electric Lifts" is the subject of a brightly-written and well-illustrated handbook just issued by Messrs. Herbert Morris, Ltd., Loughborough, England, from whom a copy may be obtained by readers mentioning this journal.

Port of Southampton Topics.

BERTHING IMPROVEMENTS NEEDED.

Included among the waterways over which the Southampton Harbour Board have authority is the tidal portion of the Hamble River, once the home of warships, but now devoted almost exclusively to yachts and yachting. Recent years have seen it gaining rapidly in favour among influential yachtsmen and now a feeling is abroad that the Harbour Board have been somewhat lacking in their care of the river as a yachting harbour. As, to a great extent, the neighbouring district owes its comparative prosperity to the attraction the river has provided for owners of pleasure craft it is urged that steps should be taken to improve the state of affairs now existing. Some well-known people have been discussing the matter in a semi-private manner, but at a recent public meeting a committee was formed with Commander C. B. Fry as chairman, to put the point of view of local yachtsmen and river-users before the Harbour Board. At this meeting reports on the condition of the river and suggested improvements were given by three experts who had conducted a detailed survey of the waterway. It was generally agreed that houseboats were allowed to monopolise far too much of the fairway and that additional accommodation was required for vessels making a prolonged stay. To effect this latter improvement it was suggested that a suction dredger should be used at certain suitable spots along the river bank and "docks" dredged out. These docks would not only relieve congestion but would afford excellent facilities for a much larger number of vessels than can be accommodated in the river at present.

"UPS" AND "DOWNS" IN TRAFFIC.

Dock statistics for November show that the port has maintained progress, despite decrease in the inward tonnage and cargo handled. The number of vessels inward was 254 against 257 during November last year, while the outgoing returns also show a decrease from 257 to 252. The gross inward tonnage dropped from 1,197,117 to 1,195,526 tons—a decrease of 1,591 tons—but the outward figures show an advance by 75,697, being 1,173,782 against 1,098,085 last year. The net tonnage dropped 2,253 inward, but rose 35,266 outward, the inward totals being 616,951 last month against 619,204 and outward totals 604,970 against 569,704. The inward cargo handled was 3,822 tons less than that of November last year, but outward there was an increase of 1,939 tons. Both inward and outward passenger totals showed an advance the former from 11,365 to 11,886 and the latter from 14,309 to 16,251 tons.

A CHOCOLATE WAREHOUSE.

Owing to its importance as a port, Southampton has been selected by Cadbury's, the chocolate and cocoa manufacturers, as a distributing centre for a 40-mile radius. In choosing Southampton the firm confess that they did so with an eye on the future. Southampton, they decided, would be ideal in the event of the company deciding to carry out their export duty from the South of England. The firm will be housed in Southampton's biggest warehouse which, known in dockland as the Sugar House, was destroyed by fire two years ago and has been rebuilt. The warehouse has been especially equipped for storing chocolate. Steam pipes and radiators and very adequate ventilation are required, especially in foggy weather, and the temperature of the rooms will have to be maintained at between 60 and 65 degrees Fahrenheit, to ensure the chocolate being preserved in its best condition. The decision of the firm in coming to Southampton is expected to eventuate ultimately in considerable shipping activity.

MARINE SUPERINTENDENT RETIRES.

Dockland has lost a popular figure by the retirement of Capt. B. Steel, R.D., R.N.R., the Marine Superintendent to the White Star Line who has been at Southampton since 1908. For six years previously he was Assistant Marine Superintendent at Liverpool, having after a long seafaring career spent the last 24 years ashore. Capt. Steel began his sea life as an apprentice in a clipper ship in 1877 when he was only 14 years of age. His successor is Capt. J. W. Williams, D.S.O., R.D., R.N.R., who for a year and a half has been Capt. Steel's assistant. He secured his master's certificate at the age of 21 when he was serving with the Leyland Line and during the war rendered valuable service as a commander of a mystery ship. Capt. Williams holds the Messina Medal given by the King of Italy for service during the terrible earthquake.

A REVISED PROGRAMME.

A substantial addition to the activities of dockland will result from the decision of New Zealand Line to add two more vessels to the list of those using Southampton as a port. These vessels will be the *Ruaphen* and the *Rimutaka*. When the Company arranged their provisional programme for 1928 only one sailing on the intermediate service by their cabin steamers was assigned to Southampton. The number of arrivals and departures as now arranged for the line will be 28.

Review.

The Ship Under Steam. By G. Gibbard Jackson. London, 1927. T. Fisher Unwin, Limited.

"The romance of the steamship is woven into the fabric of this history; technical data and anecdotes bring under review the rise of the mammoth liner from those dream ships that puffed and sank to the ruin of their makers and the glory of man." With this recommendation "The Ship Under Steam" is launched upon our attention and Mr. Gibbard Jackson steers with a light hand through the troubled waters which beset the early inventors of steam craft from 1750-1850 into the smooth passage of the modern hotel of the high seas, not forgetting to explain en route the pedigrees and achievements of many a less familiar vessel, be she tramp or trawler, destroyer or Q Boat.

This is a volume, which although not designed for the expert or ship builder affords a pleasant means of refreshing the memory on the broad lines of progress of the steamship from the efforts of the Marquis de Jouffroy on the Saône in 1783 and the earlier work of Jonathan Hulls to the inspiring triumphs of shipbuilding and marine architecture as we know them to-day.

The illustrations are pleasing and perhaps in some future edition those accompanying the chapter on "Coastal and Fresh Water Types" may include the dredger and the strangely-proportioned bulk freighter of the Great Lakes of Canada.

Tyne Improvement Commission.

New Riverside Quay for North Shields.

Improvements carried out by the Tyne Improvement Commission during 1927 included the provision of a swinging area at Tyne Main, about 1½ miles eastward of the swing bridge at Newcastle. Its diameter is about 500 ft. with a depth of about 25 ft at low water ordinary spring tides.



The New Riverside Quay now under Construction at North Shields.

At Walker, about 3½ miles eastward of the high level bridge at Newcastle, an illuminated gauge has been erected to indicate the headway of the bridge.

The illustration shows operations on the new riverside quay now in course of construction at the Albert Edward Dock, North Shields. It will be 1,100 ft. in length and complete with all necessary equipment.

The quay is due for completion in 1928 and is designed for an ultimate depth alongside of 30 ft. at L.W.O.S.T. A transit shed, 500 ft. in length and a passenger station at the rear are to be provided.

The London and North Eastern Railway Company will run dining car trains direct between King's Cross and the quay, which, in turn, will be linked up with Newcastle and the industrial areas not only by rail but by a new road constructed mainly to meet the ever-expanding motor traffic.

Tenders Invited.

COLOMBIA.

The Department of Overseas Trade has received from the British Legation at Bogota, translation of the general conditions which will govern future public calls for tender invited by the Commercial Section of the Ministry of Public Works of Colombia.

A number of copies of these conditions have been made and are now available for distribution to interested United Kingdom firms upon application to the Department, 35, Old Queen Street, London, S.W.1, quoting reference CX. 2543.

Notes of the Month.

PORT OF HAVRE TOPICS.

On November 17th, Mr. T. C. R. Orme, O.B.E., Assistant Marine Manager of the Southern Railway in Southampton, who is about to retire after twenty-two years service with the Company, was the guest of the Port of Havre Authority.

At a luncheon given on his behalf and at which many prominent people were present, Mr. Du Pasquier, President of the Chamber of Commerce and Chairman of the Harbour Board of Havre, thanked him for his work in bringing closer England and France and for his constant goodwill in regard to matters of the Havre-Southampton traffic.

Mr. Du Pasquier also presented Mr. Orme with a souvenir from the Port and Chamber of Commerce of Havre.

PORT FACILITIES AT ST. NAZAIRE.

The British Vice-Consul at St. Nazaire, France, has forwarded to the Department of Overseas Trade a report on port facilities and charges at that port. Some of the principal items dealt with include harbour facilities, official port charges, pilotage and towage, together with a disbursement account of a steamer which recently called at St. Nazaire from a European port.

A copy of the report may be consulted by firms of British origin, capital and control upon application to the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

ST. JOHN HARBOUR IMPROVEMENT.

The Hon. W. E. Foster, Chairman of the St. John, New Brunswick, Board of Harbour Commissioners, announced that the first unit in the enlarged harbour facilities for that port will include four new steamer berths and an elevator of 2,000,000 bushels' capacity. The new berths and elevator are to be located on the western side of the harbour. The announcement was also made that Mr. Alex. Gray would sever connection with the Department of Public Works of Canada on November 1st to become Chief Engineer and General Manager for the St. John Harbour Commissioners.

LIVERPOOL CARGO HANDLING.

A recent example of expeditious handling at Liverpool is that of the s.s. *Trewellard* which arrived from Port Louis, Mauritius, on December 7th with a large cargo of sugar. The vessel for which Goodyear and Co. are the agents, commenced discharging at the East Sandon Dock on the morning of the 8th and her entire cargo of over 87,000 bags of sugar was not only landed, but delivered at the warehouses of Messrs. Tate and Lyle by the 14th—an average of 14,500 bags per day. This speaks volumes for the stevedoring services and facilities offering at the port.

PORT FACILITIES AT AMSTERDAM.

The Department of Overseas Trade has received from His Majesty's Consul-General at Amsterdam an exhaustive report, giving full particulars of the facilities available at the port and all charges incurred by steamers, including cost of stevedoring and a pro-forma account of a steamer discharging a full cargo. The report also gives details of charges incurred in landing, handling and storing cargo at Amsterdam, together with some details of railway rates for small consignments and for wagon loads of not less than 5 tons on the Netherlands State Railways, together with a note as to the situation in the port as regards pilferage. Details of these charges, etc., have been circulated to steamship owners and brokers on the Department's Special Register and copies may be obtained by companies of British origin, capital and control, upon application to the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

CANADIAN WATER POWER DEVELOPMENTS.

The Dominion Water Power and Reclamation Service of the Department of the Interior of Canada has recently published a report on the Water Powers of Canada (Water Resources Paper No. 60), which gives a general survey of the water power industry and resources throughout the Dominion.

The report comprises a general review of available and developed water power and the more important industrial uses which are made of the power, together with a description of the principal water power resources and developments in each province and territory. A section is added outlining the methods practised by the Department of the Interior with a synopsis of the water power laws in force in each province.

This report, which contains 62 text pages, 5 tables, 13 plates (transmission systems, etc.), and 90 views of representative developments, may be obtained free of charge on application to the Natural Resources and Industrial Information Branch, Canadian Building, Trafalgar Square, London, S.W.1.

GRAIN ELEVATOR AT VICTORIA, B.C.

Work on clearing the ground for excavations and piling in preparing for the erection of Victoria's first grain elevator has started at Ogden Point. A million-bushel elevator ready to handle its share of the 1928 crop, is contemplated by the Panama-Pacific Grain Terminals, Ltd.

VANCOUVER ELEVATOR CONTRACT.

Announcement has been made at Calgary of the letting of the contract by the Alberta Wheat Pool for the foundations for the Pool's new terminal elevator at Vancouver. Construction is to be carried on by the Northern Construction Company, with Mr. J. W. Stewart. The elevator when completed will cost around \$2,000,000 and will have a capacity of 2,400,000 bushels. It will be the largest terminal elevator on Vancouver Harbour and will be operating for the next crop season. This year the Pool is operating under lease No. 2 terminal of the Vancouver Harbour Board which has a capacity of 1,600,000 bushels.

PORT OF PARA FACILITIES.

The Department of Overseas Trade has received from the Acting British Consul at Para a report upon the port facilities and charges at that port.

Details are given of port facilities, official port charges, stevedoring rates, etc., together with the approximate cost of handling cargo for delivery within the limits of the port.

A copy of the report may be consulted by firms of British origin, capital and control upon application to the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

PORT FACILITIES AT STOCKHOLM.

The Department of Overseas Trade has received from His Majesty's Consul at Stockholm a full report on facilities at that port, together with a statement of charges incurred by vessels, including cost of stevedoring and disbursement account of a steamer discharging cargo, and of charges incurred by cargo landed at the port.

Full particulars have been issued to steamship owners and brokers, forwarding agents, etc., on the Department's Special Register and copies may be obtained by companies of British origin, capital and control upon application to the City Office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

CAR SHIPMENT ACROSS ATLANTIC.

Reciprocal arrangements have been entered into between the Montreal Motorists' League, the Automobile Association of Great Britain and the American Automobile Association, whereby members can conveniently take their cars with them when touring Europe, or vice versa. Space can be reserved on steamers at \$285 for the round trip for cars weighing between 1,500 and 2,500 lbs. and for \$340 on cars weighing between 2,500 and 4,500 lbs. The rates include foreign registration, plates, driving license, customs pass, loading and unloading, port charges and washing and polishing car.

The Montreal Motorists' League Services will apply at Montreal for motorists both going and coming. The Secretary-Treasurer, Mr. T. C. Kirby, while in Europe recently, completed the working system. He states that enquiries indicate that there will be a large traffic in 1928, of motorists taking their own cars to and from Europe. Many Americans will tour through Canada embarking at Montreal for Liverpool and other ports.

GRAIN EXPORTS AT VANCOUVER.

It is anticipated that the Port of Vancouver will achieve another high record in grain shipments during the 1927-28 crop year, and predictions of a total of 75 million bushels are being confidently made. The port record in 1924-25 was 55 million bushels and little doubt is entertained that this will be exceeded by nearly 20 million bushels. For November loading 6 million bushels were booked; 20 million bushels for December and 10 million bushels for January, and it appears certain that movement will continue well into February, March and the early part of April.

Announcements appeared recently to the effect that 100 ships had been fixed to load full cargoes of grain at Vancouver during the months of December and January. Vancouver grain dealers now assert, however, that in December alone fully 100 ships will load grain in the port. Practically all space bookings announced are for the United Kingdom or the Continent and it is expected that the movement to Japan and China will start later.

The growing importance of Vancouver as a world port is strikingly illustrated by the fact that during the month of October, 1927, 121 deep-sea ships entered and cleared the port. This total is exclusive of coastwise shipping.

Bombay Port Trust.

Administration Report for the Year 1926-27.

The original estimates of receipts for the year 1926-27 were framed on the assumption that there would be a slight improvement in trade conditions as compared with the previous year. Calculations were, however, vitiated by the extraordinary trade conditions which prevailed throughout the year. The disastrous and prolonged coal strike in England, the civil strife in China and the absence of demand from Europe were factors which acted adversely both on imports and exports. The abnormal American cotton crop, combined with the high level of prices for Indian cotton as compared with the American staple and the late arrival of the crop into Bombay were responsible for a considerable falling off in exports of raw cotton during the year. These causes led to a serious diminution of the Trustees' receipts, and it was obvious that the year's working would show a heavy deficit. To counterbalance the fall in receipts and reduce the deficit to more moderate proportions the energies of the administration and all its departments were concentrated on retrenching working expenses in every possible direction. As a result of these efforts, the actual expenditure for the year shows a saving of Rs.12.14 lakhs on the original expenditure estimates and Rs.4.73 lakhs on the revised estimates. As compared with the actual expenditure of the previous year 1925-26, the expenditure for 1926-27 shows a reduction of Rs.1.45 lakhs, in spite of additional expenditure of Rs.3.36 lakhs being incurred in 1926-27 on dredging the Pir Pao Channel, and of Rs.1.55 lakhs and dock police, water rates to the Municipality, and other items over which the Port Trust have partial or no control.

The receipts under all heads, including Rs.44,11,836 from surtaxes, amounted to Rs.2,64,02,352, against the original estimates of Rs.2,87,51,900 and the revised estimates of Rs.2,62,93,600. As compared with the actuals of the preceding year 1925-26, the receipts for the year under report show a decrease of Rs.20,11,196 or about seven per cent. Details of the receipts are given hereafter. The total expenditure (excluding special, met from special receipts) totalled Rs.2,75,07,995, the result of the year's working being a deficit of Rs.11,47,082 under General Account which has been met from the Revenue Reserve Fund, and a surplus of Rs.41,439 under Pilotage Account for transfer to the Vessels Replacement Fund under this account. The revised estimates framed in January, 1927, anticipated a deficit of Rs.16,92,136 under General Account for the year under report, and the reduction of the actual deficit to Rs.11,47,082 was due to an improvement of Rs.96,749 in the receipts and a saving of Rs.4,48,305 in expenditure as compared with the revised estimates.

There was no increase in the scale of dock or port charges during the year under report, but, on the contrary, reductions and concessions were sanctioned, wherever feasible, to afford facilities to the trade. The Trustees await a revival of trade at the port to enable them to make further reductions in the scales of charges on shipping and goods.

The increasing activities of the Kathiawar ports and the diversion of traffic thereto from Bombay and other ports caused the Trustees, together with the Chambers of Commerce and other Associations, to make a representation to Government. The question has now been decided by the Government of India re-imposing the land Customs cordon at Viramgaum, and it is hoped that this will put a stop to the unfair diversion of trade from this port.

The total tonnage of cargoes dealt with at the docks and bunders during the year was 5,593,000 tons, against 6,460,000 tons in 1925-26. The following figures show the comparison in detail:—

	Imports.		Exports.	
	1925-26	1926-27	1925-26	1926-27
Docks	2,283,000	2,065,000	2,580,000	2,003,000
Bunders	1,193,000	1,094,000	404,000	431,000
Total	3,476,000	3,159,000	2,984,000	2,434,000

It will be seen that there was a reduction of 317,000 tons in imports and 550,000 tons in exports as compared with the preceding year. The decrease was heavier in the cargoes dealt with at the docks than at the bunders.

A redeeming feature of the trade of the year under review was the record increase in the importations of petrol, which amounted to 10,017,000 gallons, as against 7,444,000 gallons in 1925-26. The entire quantity, which came from Burma, was expeditiously discharged at the Pir Pao Pier, and pumped into the installations at Sewri. The ferro-concrete jetty at this pier was replaced by a steel jetty at a cost of about Rs.6 lakhs.

The Docks Hamallage (Labour) Department satisfactorily met all demands for labour during the year, and it is pleasing to record that the attendance of the labourers continued to be satisfactory and that harmonious working was not disturbed by any industrial dispute. The average number of labourers

engaged daily was 2,229, against 2,506 in 1925-26, and the highest number employed on a single day was 3,734, against 4,157 in the previous year. The total tonnage of goods handled during 1926-27 amounted to 3,405,058 tons, the inclusive labour charges averaging 4.13 annas per ton as compared with 3.91 annas per ton in 1925-26. The small increase is due to the heavy fall of about 600,000 tons in exports, which has disturbed the equilibrium between the volume of imports and exports, the cost of handling the latter being slightly less than that of the former.

The docks revenue collections for 1926-27, excluding recoveries from Hamallage and Sanitary Departments, amounted to Rs.139.18 lakhs, as against actuals of Rs.149.45 lakhs during the previous year. The principal decreases occurred under wharfage on goods (Rs. 4.19 lakhs), dock dues on vessels (Rs.0.74 lakhs), crannage (Rs.0.56 lakhs), and surtax (Rs.3.41 lakhs).

The fumigation of American cotton imported into India through this port continued throughout the year under review, and owing to the disparity in prices ruling between the American and Indian varieties, the imports were on a considerably enhanced scale. 138,597 bales were landed and fumigated prior to delivery. In order to render the costs of fumigation cheaper for the trade, Government reduced their proportion of the fumigation charge by four annas a bale, and the Trustees responded with a reduction of one anna per bale out of their share of four annas per bale from February, 1927. The Trustees also waived the recovery of the special storage charge of eight annas a bale during the monsoon months.

There was a decrease in the number of vessels occupying the dry docks, the number of vessels docked being 177, against 200 in 1925-26. The total tonnage decreased to 625,803 tons, being 88,170 tons less than the previous year. The departmental working of the dry docks was carried out successfully and economically throughout the year, the expenditure being the lowest on record. As a convenience to vessels undergoing repairs in the dry docks, the Trustees purchased a portable motor transformer in order to provide vessels with electric current from the shore mains at a suitably reduced voltage.

The Ballard Pier berth was used by 169 vessels, as against 178 during 1925-26. Postal and passenger trains to and from the station connecting with the incoming and outgoing mail steamers were run regularly during the year, the number of special trains being 281, against 301 in the previous year. The temporary hotel accommodation provided at the station for the convenience of ocean-going passengers was made use of by 2,934 adults and 329 children, as against 3,156 adults and 458 children in 1925-26. The east wing of the hotel, comprising 24 rooms, was demolished during the year under report and the ground laid out as a lawn and garden.

The additional passenger berth on the Alexandra Dock Harbour wall accommodated 55 vessels, against 48 in the previous year.

The total tonnage dealt with at the bunders was 1,525,358 tons, against 1,596,814 tons during 1925-26, the principal decreases being in chunam, firewood, timber, seeds and vegetables and fruits. There were increases, however, under petrol and kerosene oil.

On the land estates, there was a falling off in the occupations of sheds and godowns, principally at the Grain and Cotton depots. The Trustees have now decided to allow the Grain depot to be used for occupations other than grain, and accommodation has been leased for bone crushing, chemicals and china-clay in bulk. In spite of the reduction of the godown rents at Cotton Depot made last year, there were 22 vacant godowns at the close of the year under review.

There was a decrease in the foreign inward and outward traffic on the Port Trust Railway, which aggregated 424 lakhs of maunds against 500 lakhs during 1925-26. The principal decreases occurred in cotton, cotton-seed, manganese ore, grain and seeds. A decrease of 12,862 wagon loads has also to be recorded in local traffic, also under the same items. The bulk of the cotton for export continued to be conveyed from the depot to the docks by carts and lorries, in spite of the reduction in the railway rates introduced last year.

In view of the depression in trade and the consequent effect on the Board's revenues, capital expenditure during the year under review was kept down to an absolute minimum, in order to obviate any increase in debt charges. Expenditure on Capital Account amounted to Rs.21.81 lakhs, which is the lowest since 1904-05. A sum of Rs.6.75 lakhs was expended on the construction of the new transit shed at No. 9 berth, Alexandra Dock, Rs.4.40 lakhs on the deepening of the Alexandra Dock entrance channel and mail steamer berth, Rs.4.21 lakhs on dredging plant, Rs.1.27 lakhs on paving and metalling of wharves in Alexandra Dock, and Rs.77,000 on the construction of a new office for the deputy manager and cash department in Alexandra Dock. No new loan was raised by the Trustees during the year, the expenditure being financed from loan balances in hand.

REVENUE DETAILS.

The year's Revenue, excluding Special Receipts, compares with that of previous years as follows:—

Average of three years ending 1920-21	...	...	...	Rs. 2,04,16,756
Do. do. 1923-24	...	...	...	Rs. 2,45,83,917
During the year 1924-25	...	...	...	Rs. 2,73,76,984
Do. 1925-26	...	...	...	Rs. 2,84,13,548
Do. 1926-27	...	...	...	Rs. 1,64,02,353
Average ..				2,73,97,628

Compared with the last five years the result of the working of the past year is as follows:—

	Income.			Surplus.	Deficit.
	Revenue Proper.	Surtax.	Special Receipts.		
	Rs.	Rs.	Rs.		
1921-22 ...	2,04,44,158	12,73,481	7,89,615		
1922-23 ...	2,09,96,302	49,66,049	8,71,019		
1923-24 ...	2,14,27,766	46,44,046	9,26,766		
1924-25 ...	2,26,02,556	47,75,428	9,48,694		
1925-26 ...	2,36,53,748	47,59,801	9,53,590		
1926-27 ...	2,19,90,516	44,11,886	11,56,821		
	Expenditure.		Special Expenditure.	Rs.	Rs.
	Expenditure Proper.				
	Rs.	Rs.			
1921-22 ...	2,27,77,995	7,92,082	—	—	10,62,804
1922-23 ...	2,57,74,652	8,26,502	2,32,216		
1923-24 ...	2,61,90,386	9,36,012			1,27,820
1924-25 ...	2,73,20,809	9,65,025	39,844		
1925-26 ...	2,76,53,225	10,03,623	7,10,291		
1926-27 ...	2,75,07,995	11,98,260	—		11,47,082

COMPARATIVE RECEIPTS.

Comparison of Receipts under the various heads for the past two years.

Budget Head.	1925-26.	1926-27.
SECTION I.		
BUNDERS.	Rs.	Rs.
Wharfage fees ...	15,92,467	16,35,319
Basin rents and hard fees ...	88,947	82,912
Extra fees and wharf ground rents ...	32,730	31,957
Revenue from other sources ...	2,48,108	2,36,750
Surtax ...	2,93,085	2,85,603
	22,55,327	22,72,541
SECTION II.		
LAND.		
Ground rents ...	28,12,462	28,68,742
Warehouse, shed and godown rents ...	21,79,620	19,31,549
Revenue from other sources ...	1,03,428	97,752
	50,95,510	49,18,043
SECTION III.		
RAILWAY DEPARTMENT.		
Freight—Local and through ...	9,85,529	7,79,351
Terminal charges ...	15,56,248	13,96,645
Revenue from other sources ...	2,46,170	1,34,987
	27,87,942	23,10,983
SECTION IV.		
PRINCES, VICTORIA & ALEXANDRA DOCKS.		
Dock dues on goods ...	66,42,968	62,23,976
Dock dues on vessels ...	5,98,499	5,24,695
Ground and shed rents ...	5,78,164	6,35,969
Night and holiday work ...	1,79,147	1,74,379
Cranage ...	5,63,741	5,07,528
Unloading carts and wagons ...	1,99,991	1,43,023
Warehouses ...	6,86,372	6,64,310
Overside charges ...	3,13,453	1,83,592
Recoveries on account of hamallage and sanitary ...	4,72,178	3,15,999
Revenue from other sources ...	8,02,854	8,21,673
Surtax ...	43,79,759	40,39,212
	1,54,17,126	1,42,34,856
SECTION V.		
MEREWETHER & HUGHES DRY DOCKS.		
Dues from vessels ...	3,83,337	3,30,458
SECTION VI.		
Interest and miscellaneous ...	14,73,137	13,35,208
SECTION VII.		
Port Department ...	5,35,481	5,33,057
Total Revenue (General and Port Department)	2,79,47,860	2,59,34,646
Pilotage Account ...	3,78,732	3,80,682
Surtax ...	86,956	87,021
	4,65,688	4,67,703
Special Receipts ...	9,53,590	11,56,821
Grand total ...	2,93,67,138	2,75,59,170

REVENUE RESERVE FUND.

The deficit for the year under report amounting to Rs. 11,47,082 has been met from the Revenue Reserve Fund, which will thereafter stand as follows:—

Total as per Administration Report, 1925-26	...	Rs. 79,99,332
Add—Amount transferred from Securities Depreciation Fund, 1926-27	...	3,56,166
		83,55,498
Deduct—Revenue deficit 1926-27	...	Rs. 11,47,082
Withdrawals for special purposes, 1926-27:—		
To meet interest for three months ending 31st March, 1927, on Loans from Government in 1921-22 and 1923-24 in addition to the annual equated payment	...	3,14,301
To meet arrears of rent to 31st December, 1925, in respect of new Police Station and quarters	...	1,26,238
To meet arrears of pay, etc., in respect of Military Assistant Surgeon on the staff of the Port Health Officer	...	25,734
		16,13,350
*Invested in public securities of the par value of Rs. 65,69,700	...	Rs. 65,15,167
Cash balance	...	2,26,981
Total	...	67,42,148

Taking the securities at their market value and adding the amount set aside in the Securities Depreciation Fund against depreciation of Revenue Reserve Fund securities, the actual value of the Revenue Reserve as at 1st April, 1927, amounts to about 63½ lakhs of rupees.

BUNDERS AND LAND REVENUE.

Owing to the heavy importations of petrol, the revenue from the bunders does not show any serious falling off as compared with the previous year, the collections for 1926-27 being only Rs.15,000 less than those for 1925-26. On the land estates, rents from leaseholds and open-air occupations show an increase of Rs.75,000 over last year, but rents from sheds and godowns have fallen by Rs.2½ lakhs.

WHARFAGE FEES.

Wharfage fees on merchandise at the docks and bunders amounted to Rs.78,59,296, being a decrease of Rs.3,76,140 as compared with the corresponding figure for 1925-26. The decrease is due to the depression of trade prevalent during the year. Transshipment fees on cargo amounted to Rs.1,68,193, an increase of Rs.40,279 as compared with the fees for the year 1925-26.

The following figures show the comparison of import and export wharfage for the last three years:—

Year.	Import Wharfage.	Export Wharfage.	Total.
	Rs.	Rs.	Rs.
1924-25	46,08,199	30,26,476	76,34,675
1925-26	49,51,751	32,83,685	82,35,436
1926-27	51,58,968	27,00,328	78,59,296

DOCK DUES ON VESSELS.

The receipts from dock dues on vessels amounted to Rs. 5,24,695, a decrease of Rs.73,804 as compared with the year 1925-26.

GROUND AND SHED RENTS AT THE DOCKS.

Ground and shed rent receipts at the docks aggregated Rs.6,35,969, an increase of Rs.57,805 as compared with the year 1925-26. The increase is due to tardier clearances of cargoes from the transit sheds.

CRANAGE FEES AT THE DOCKS.

The receipts from cranage fees at the docks amounted to Rs.5,07,528, against Rs.5,63,741 in 1925-26, a decrease of Rs.56,213.

SURTAX IN THE DOCKS, BUNDERS AND PILOTAGE DEPARTMENTS.

The amounts collected on account of surtaxes on rates in the different departments were as follows:—

Wet Docks	...	40,39,212
Bundars	...	2,85,603
Pilotage Account	...	87,021
		44,11,836

LAND ESTATE GROUND RENTS.

Ground rent receipts at the bunders and from the land estates amounted to Rs.28,88,741, an increase of Rs.76,280 as compared with the previous year. The increase is due to enhanced rents from leaseholds and a slightly higher demand for monthly tenancies, seasonal and casual occupations. The following figures afford a comparison:—

	Rents realised.		Total.
	From leaseholds.	From monthly tenancies.	
	Rs.	Rs.	Rs.
1922-23	14,49,291	15,72,444	30,21,735
1923-24	15,44,361	15,27,450	30,71,811
1924-25	15,76,083	12,94,011	28,70,094
1925-26	16,15,680	11,96,781	28,12,461
1926-27	16,42,193	12,46,548	28,88,741

The total area of land let on leasehold at the end of the year was 1,396,644 square yards, against 1,388,006 yards at the close of 1925-26. The number of leases existing on Port Trust estates on 31st March, 1927, for which bills are rendered, was 549 against 546 on the 31st March, 1926.

MEREWETHER AND HUGHES DRY DOCKS RECEIPTS.

The revenue from the Merewether and Hughes Dry Docks amounted to Rs.3,30,459, as against Rs.3,83,337 in the previous year, or a decrease of Rs.52,878. The gross tonnage dealt with was 625,803 tons, against 713,973 tons in the previous year, or a decrease of 88,170 tons. The expenditure on working the Dry Docks was Rs.2,29,125, as against Rs.2,51,725 in the previous year, or a decrease of Rs.22,600. The proportion of working expenses to receipts during 1926-27, though slightly higher than last year, compares very favourably with the expenditure in previous years before the introduction of the departmental working of the Dry Docks.

PORT TRUST RAILWAY RECEIPTS.

The receipts of the railway during the year amounted to Rs.23,10,984, as against Rs.27,87,912 in the previous year, a decrease of Rs.4,76,958. Terminal charges were paid during the year by the two railways at six pies per maund, the rate provisionally fixed by Government pending their final orders on this question, which is still under consideration by Government.

The traffic earnings on account of the G.I.P. and B.B. and C.I. Railways and paid over to them totalled Rs.2,71,81,000, as against Rs.3,38,68,000 in 1925-26.

INTEREST AND MISCELLANEOUS RECEIPTS.

The receipts under this section amounted to Rs.13,25,208, as against Rs.14,73,137 in the preceding year. The decrease is due to smaller receipts of interest on fixed deposits owing to the average official bank rate of interest being much lower in 1926-27 as compared with the previous year.

PORT DEPARTMENT.

The revenue of the Port Department amounted to Rs.5,33,058 as against Rs.5,35,481 in the previous year, a decrease of Rs.2,423.

The Pilotage receipts, including interest on investments of the Vessels Replacement Fund, totalled Rs.4,93,095, as against Rs.4,89,376 in 1925-26. Pilotage, transporting and pilots' attendance fees realised Rs.3,50,303, against Rs.3,49,797 in the previous year. The receipts from surtax amounted to Rs.87,021. The Pilotage Account closed with a surplus of Rs.41,439, which has been transferred to the Vessels Replacement Fund.

To replace the steam pilot vessel "Kennery," hired from Government, the Trustees have placed an order for a new steam pilot vessel estimated to cost Rs.3.37 lakhs. His Excellency the Governor of Bombay has been graciously pleased to allow the new pilot vessel to be named after Her Excellency as the "Lady Wilson."

REVENUE EXPENDITURE (DETAILS).

The total expenditure charged to Revenue under the several heads of account is compared with the actuals of 1925-26, and the revised budget estimates for 1926-27 in the following statement:—

	Actuals, 1925-26.	Revised Budget, 1926-27.	Actuals, 1926-27.
	Rs.	Rs.	Rs.
Section I.—General charges...	22,64,570	25,33,873	24,78,026
" II.—Bunders and land ...	15,56,743	21,66,494	19,26,978
" III.—Railway department ...	19,41,146	17,32,702	17,26,436
" IV.—Wet docks ...	69,68,063	67,90,523	67,00,108
" V.—Dry docks ...	2,51,725	2,61,806	2,29,125
" VI.—Rents ...	1,34,523	1,34,524	1,34,523
" VII.—Debt charges ...	1,32,11,057	1,32,07,323	1,32,07,224
" VIII.—Special repairs and re- newals ...	4,54,000	2,54,000	2,54,000
" IX.—Port department ...	4,55,743	4,48,789	4,25,311
Total expenditure (general and port department) ...	2,72,37,570	2,75,30,036	2,70,81,731
Pilotage ...	4,15,655	4,28,594	4,26,264
Special expenditure ...	9,53,590	10,83,500	11,56,821
Grand total ...	2,86,06,815	2,90,42,130	2,86,64,816

The increase under Section I., General Charges, is due to higher engineering charges debitable to Revenue Account in consequence of the curtailment of capital works, and to the full expenditure on repairs and maintenance of the Chief Engineer's flotilla of barges being now shown under this section. The expenditure on salvage plant has also been shown under this section for the first time. The increase under Section II., Bunders and Land, is entirely due to the expenditure of Rs.3.40 lakhs which had to be incurred in 1926-27 on dredging the Pir Pao access channel and turning circle. The savings over the revised budget estimates shown in the last column of the above

statement indicate the economies effected in expenditure in the different departments.

DEBT.

In view of the depressed condition of trade and the necessity to avoid any increase in debt charges, the Trustees curtailed their Capital programme by postponing all works not immediately essential. No new loan was therefore necessary during the year under report.

TOTAL DEBT.

The total debt of the Board at the close of the year amounted to Rs.22,51,77,797, of which Rs.7,71,12,121 was due to Government and Rs.14,80,65,676 was on account of the Fore-shore Securities and Debenture Loans due to the public.

TOTAL EXPENDITURE ON CAPITAL ACCOUNT.

The total expenditure on Capital account since the constitution of the Trust amounts to Rs. 23,47,60,897, from which Rs.11,73,904 (being receipts from sale of old plant, etc., paid to Government in reduction of debt to 31st March, 1914) has to be deducted, leaving Rs.23,35,86,903. The cost of the old lighthouse *Colaba*, the Kennedy and Dolphin lighthouses, and certain other properties originally made over to the Trustees by Government free of charge are not included in this amount, and it also does not take into account the invested funds and unspent balances of loans aggregating Rs.5,82,26,816 as under:—

	Rs.
General Sinking Fund	2,87,25,015
Victoria Dock Sinking Fund	70,26,123
Revenue Reserve Fund (par value and cash balance uninvested)	67,42,148
Depreciation, Emergency, Fire Insurance and other funds for special purposes	86,42,599
Cash being amount of unspent balances of loans	70,90,931
	Rs.5,82,26,816

TRADE AND TRAFFIC STATISTICS.

AGGREGATE VALUE OF TRADE OF YEAR.

The value of the trade of the port as shown in the Customs return, inclusive of Government transactions, was Rs. 245 crores, as compared with Rs.304 crores in the previous year, a decrease of about 19 per cent.

The most noticeable feature under imports were the record importations of liquid fuel and petrol. The increases in the bulk importations of these commodities over the figures for last year were: liquid fuel, 6,942,000 gallons; and petrol, 2,574,000 gallons.

Imports of coal increased from 293,000 tons to 299,000 tons. Imports of kerosene oil in bulk increased by 667,000 gallons, and of case oil by 272,000 gallons. There was an increase of 21,000 bales and cases of piecegoods and 4,000 bales of twist and yarn.

Decreases in imports have to be recorded under cotton (11,000 bales), rice (56,000 tons), iron and steel (31,000 tons), and machinery, boilers, and railway materials (20,000 tons).

In the export trade, the most noticeable feature was the increase in liquid fuel from 19½ million gallons to a little over 20 million gallons. Exports of coal showed an increase of 25,000 tons. There was an increase of 32,000 bales and cases of piecegoods exported and 17,000 bales of twist and yarn. On the other hand, important decreases occurred in cotton (740,000 bales), wheat (29,000 tons), groundnuts (34,000 tons), kerosene oil in bulk and cases (359,000 gallons), manganese ore (40,000 tons), and seeds (202,000 tons).

TRAFFIC AT WAREHOUSES.

The traffic at the warehouses during 1926-27 compared with that of the two previous years was as follows:—

		1925-26.		1926-27.	
		Receipts.	Deliveries.	Receipts.	Deliveries.
Package Goods—					
Piece-goods and yarn	Packages	133,258	141,546	130,008	130,739
Miscellaneous goods	...	155,731	168,928	150,053	148,254
Total	...	288,989	310,474	280,061	278,993
Weight goods—					
Miscellaneous	...	8,723	9,427	10,139	10,493
Metal	...	7,905	8,219	7,471	7,344
Total	...	16,628	17,646	17,610	17,837

There was hardly any improvement in the demand for accommodation at the duty paid warehouses. The stock of piecegoods and yarn on 31st March, 1927, was 36,000 packages, as against 37,000 packages on 31st March, 1926, and 45,000 packages on 31st March, 1925. In view of the interchangeability of the staff of the warehouses with that of the docks, working hours in the warehouses were revised to conform to the ordinary docks working hours.

DOCKS BONDED WAREHOUSES.

The traffic at the docks bonded warehouses was as follows:—

		1925-26.		1926-27.	
		Receipts.	Deliveries.	Receipts.	Deliveries.
Package goods—	Packages	37,064	39,236	20,068	25,254
Miscellaneous	...	13,372	14,956	24,316	20,946
Weight goods—					
Miscellaneous	...	24,952	25,581	44,432	24,832

The balances of piecegoods, twist and yarn at the docks bonded warehouses on 31st March, 1927, was 3,710 packages as against 8,896 packages on 31st March, 1926, and 5,068 packages on 31st March, 1925.

In the closing months of the year under review, a brisk demand arose for bonded accommodation, particularly for sugar, and several additional warehouses, inclusive of the sales warehouse, had to be reserved for bonded goods. This demand is reflected in the heavy carry-over of the stock of miscellaneous goods which amounted to 22,870 tons as against 3,260 tons at 31st March, 1926.

DOCKS HAZARDOUS GOODS WAREHOUSE.

The receipts and deliveries at this warehouse during 1926-27 compared with those of the two previous years were as follows:

		1924-25.		1925-26.		1926-27.	
		Receipts.	Deliveries.	Receipts.	Deliveries.	Receipts.	Deliveries.
Packages	...	9,693	10,101	8,615	8,678	6,774	6,713

SALES OF UNCLEARED CARGOES.

The sale of uncleared cargoes landed at the docks and bunders was carried out during the year and the total gross proceeds for the six sales held amounted to Rs. 35,926 as against Rs. 24,961 in 1925-26. The number of packages sold during the year was 3,738 as against 3,599 last year.

VESSELS ENTERED.

Number of vessels engaged in trade that entered the port during the past ten years, as shown in the Customs returns:—

Year.	Steamships.					
	Foreign Trade.		Coasting Trade.		Total.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1917-18	434	1,192,937	1,379	886,020	1,813	2,078,957
1918-19	434	1,204,447	1,533	859,597	1,967	2,064,044
1919-20	732	2,206,439	1,774	1,392,824	2,506	3,599,263
1920-21	727	2,234,712	1,944	1,811,256	2,671	4,045,968
1921-22	784	2,492,516	2,181	2,097,099	2,965	4,589,615
1922-23	643	2,284,069	2,709	2,023,208	3,352	4,307,277
1923-24	643	2,447,377	2,261	1,991,348	2,904	4,438,725
1924-25	638	2,371,305	2,461	2,050,725	3,094	4,422,030
1925-26	652	2,434,409	2,546	2,090,328	3,198	4,524,737
1926-27	581	2,239,909	2,450	2,169,023	3,031	4,408,932

Year.	Sailing Vessels.					
	Foreign Trade.		Coasting Trade.		Total.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1917-18	345	40,902	26,747	493,044	27,092	533,946
1918-19	320	44,549	46,465	676,422	46,785	720,971
1919-20	264	34,536	43,724	587,731	43,988	622,267
1920-21	203	25,801	49,603	750,741	49,806	776,542
1921-22	200	26,503	55,138	785,060	55,338	811,563
1922-23	141	18,866	46,057	674,369	46,198	693,235
1923-24	150	19,082	55,438	699,744	55,588	718,826
1924-25	154	20,035	40,002	605,342	40,156	625,377
1925-26	144	17,812	45,028	572,921	45,172	590,733
1926-27	113	15,178	37,813	394,923	37,926	410,101

DIMENSIONS OF VESSELS ENTERING THE DOCKS.

Of the vessels which entered the docks 67 were over 470 ft. in length and 40 between 450 and 470 ft., as against 61 and 34 respectively, in 1925-26. Of the vessels over 470 ft. in length, 27 were over 500 ft. long and 25 between 490 and 500 ft.

DIMENSIONS OF VESSELS ENTERING AND LEAVING THE PORT.

The largest vessel that entered the port was the s.s. *Belgenland*, length 670 ft., beam 78 ft., and gross tonnage 27,132 tons. This vessel also left the port with the deepest draft, i.e., 31 ft. 10 in.

VESSELS DISCHARGING LIQUID FUEL AND BURNING OIL.

Forty-four vessels discharged liquid fuel at Nos. 18 and 19 berths, Alexandra Dock Harbour Wall and K berth, Prince's Dock, during the year. The number of oil-burning vessels excluding tankers entering the port during 1926-27 was 176.

DETENTION OF VESSELS.

Thirty vessels were detained in the stream for periods varying from 1 day to 5 days awaiting accommodation in the docks. In the case of 25 vessels the detention was for 2 days or less;

2 vessels were detained for 3 days, 2 vessels for 4 days and 1 vessel for 5 days.

DRY DOCKS.

The following figures show the occupation of the dry docks:

		Days.	Days.
		1925-26.	1926-27.
Merewether Dry Dock	...	284½	261½
Hughes Dry Dock	{ Inner Section 211½ }		114½
	{ Outer Section 87½ }	299	148
			28½

The inner section of the Hughes Dry Dock was closed from the 24th February, 1927, in connection with the work of strengthening the caisson stops.

The largest vessel dry-docked during the year was the ss. *Ranchi* in the Hughes Dry Dock, 16,650 gross tonnage, 547 ft. long, 71 ft. beam.

As the levy of actual extra expenses for docking and undocking vessels on Sundays was found inconvenient in practice and resulted in delay in the submission of bills, the Board sanctioned a fixed scale of charges based on the tonnage of vessels.

Miscellaneous.

HARBOUR INSPECTION.

In pursuance of the general policy of retrenchment, the trustees' inspection of Port Trust works was not held during the year under report.

SOUTH AFRICAN DEPUTATION TO INDIA.

On the occasion of the visit of the South African delegation to this city in September, 1926, the trustees arranged a programme of inspection of the Port Trust docks, works and land estates and thereafter entertained the delegation with other distinguished guests to a luncheon at the Ballard Pier Station.

STORES DEPARTMENT.

The prices of many commodities, including coal, were lower than last year. Contracts for Port Trust supplies were entered into in the case of oils, castings, stationery, timber, provisions, uniform clothing, petrol, liquid fuel, coke, ropes and cords, furnishings and water fittings, hardware, textiles, tools and workshop appliances and miscellaneous country stores. Few articles were therefore purchased through the medium of casual tenders, but quotations for all items above the value of Rs. 5,000 were invited by public advertisement. Supplies of first-class steam coal from Bengal were obtained during the year from Messrs. Bird and Co., who secured the contract by open tender. Supplies of second-class coal for use on the Port Trust Railway continued to be obtained through the Mining Engineer of the Railway Board.

The cost of the stores purchased by the Controller of Stores and the Chief Engineer during the year was as under:—

		Foreign		
		Indigenous.	Purchased in India.	Purchased through London Agents
By the Controller of Stores	Rs.	12,02,000*	Rs. 7,66,000	Rs. 84,000
By the Chief Engineer	...	3,32,000	4,42,000	1,48,000
Total Rs.		15,34,000	Rs. 12,08,000	Rs. 1,82,000
Coal	...	...	Rs. 8,16,800.	
Miscellaneous	...	...	Rs. 3,85,200.	

Considerable attention was paid during the year to the reduction of stores held in stock by the Controller of Stores and the Chief Engineer. The Board also passed definite orders that with the exception of a few items like cement, railway sleepers, etc., which the Chief Engineer's Department could purchase and stock more conveniently than the Stores Department, all other purchases should be made by the Controller of Stores.

BUNDERS AND LAND DEPARTMENT.

BALLARD ESTATE.

The Trustees decided to name one of the two leasehold buildings voluntarily surrendered to them last year, "Thackersey House," in commemoration of the valuable services rendered to the port by the late Sir Vithaldas Damodar Thackersey as a Trustee during the years 1913-22; 3½ floors of this building have been leased to the Postal Department at a rental of Rs. 30,000 per annum and the remainder is being converted into a much needed Institute in connection with the Bombay Port Trust Sports Club.

ELPHINSTONE ESTATE.

An area of 4,779 sq. yds. has been leased near Frere Basin to the Asiatic Petroleum Co. (India), Ltd., for a bulk lubricating oil installation. The Trustees sanctioned a lay-out of plots on this area for the accommodation of lubricating oils, with the necessary road and railway sidings.

MAZAGON COTTON DEPOT.

The Bombay Cotton Merchants' and Muccadums' Association completed the erection of their dispensary and offices in Exchange Avenue. A small area of additional land was leased to them for the dispensary.

The Fire Insurance Association considered a revision of their tariffs and it is understood that the rate of insurance on cotton stored at the Trustees' Cotton Depot has been further reduced by about 5 per cent. from 1st April, 1927, as compared with that in private godowns.

GRAIN DEPOT.

The following accommodation was let out for occupations other than grain at this depot:—

Area.	Party.	User.
611 1/9th sq. yards	Messrs. J. A. Boggie & Co.	Godown for screening and storage of crushed bones and for storing and crushing myrabollams
4,610 6/9ths sq. yards	Messrs. Brunner Mond & Co. (India) Ltd.	Godown for storage of chemicals
6,111 sq. yards	Messrs. Sizing Materials Co.	Godown for storage of bulk china-clay, etc.

The Trustees sanctioned the lease of about 122 acres on the reclamation to the New Golf Club, Ltd., at a rental of Rs. 150 per month. The lease is for 10 years, but the Trustees have the right to resume any area required by them on one month's notice.

PIR PAO PIER.

An extended use was made of this pier during the year under report. Thirty vessels discharged petrol and kerosene oil as compared with the 26 vessels in the previous year. The quantities discharged were as under:—

	1924-25.	1925-26.	1926-27.
Petrol, Gallons ...	6,253,311	7,443,903	10,017,162
Kerosene, Gallons ...	24,972,187	30,494,648	26,531,307
	31,225,498	37,938,551	36,548,469

FIRES.

There were nine fires on the Trustees' land estate as compared with seven in 1925-26. Fortunately none of them involved any serious loss.

TOWN DUTY.

The Town Duty collected on behalf of the Municipality at the docks and bunders during the year under report amounted to Rs. 28,81,599 as compared with Rs. 28,58,208 in the preceding years 1925-26.

REVISION OF HARD FEES.

The Trustees revised the "Break-up" Hard Fees so as to effect a reduction on the amounts payable in respect of large ships.

RAILWAY DEPARTMENT.

TRAFFIC.

In consequence of the depression in trade, there was a decrease in traffic on the Port Trust Railway as compared with last year, both in foreign and local traffic. The number of wagons received and despatched during the last two years compares as follows:—

	Inward.		Outward.	
	1925-26.	1926-27.	1925-26.	1926-27.
Foreign ...	86,127	68,587	53,450	49,495
Local ...	41,146	30,069	42,250	30,766
Total ...	127,273	98,656	95,700	80,261

TROOP AND PASSENGER TRAINS.

During the year 86 troop and other special trains were run over the railway as against 35 in the previous year. In addition, 281 postal and passenger expresses were run to and from the Ballard Pier Station as against 301 in the previous year.

SUPPLY OF WAGONS.

The supply of foreign wagons was satisfactory, but there were occasional delays in obtaining special types of wagons. In certain cases, the supply of wagons for traffic to stations on the G. I. P. and B. B. & C.I. Railways situated near Bombay was supplemented by the use of B. P. T. wagons under special arrangements.

VERNACULAR SCHOOLS AT WADALA AND ANTOP.

The Wadala School maintained its reputation in regard to the number of pupils, attendance records and examination results. The branch school at Antop Village completed its first year with highly satisfactory results. The expenditure on the school, including cost of annual prizes, amounted to Rs.4,891, including the cost of the new school at Antop Village.

RAIL-BORNE TRAFFIC INTO THE DOCKS.

Rail-borne merchandise taken direct into the docks amounted to 479,986 tons, a decrease of 160,447 tons as compared with the previous year. The principal decreases were in seeds, 76,334 tons; cotton seeds, 60,354 tons; cotton, 21,082 tons, and in manganese ore, 9,984 tons.

ACCIDENTS ON THE RAILWAY.

Eighteen accident cases were reported to Government during the year under the provisions of the Indian Railways Act. Seven of these involved injuries, none of which proved fatal. In no case was the railway held to blame. Medical aid was promptly obtained in all cases.

There were 32 cases of derailments during shunting operations during the year. Of these 14 were derailments of engines and 18 of wagons.

PRINCE'S, VICTORIA AND ALEXANDRA DOCKS. FIRES.

There were 10 fires at the docks, wharves and sheds and on board vessels and craft while in the docks, against 16 in 1925-26. None of them was serious or involved loss of life. The fire gear of the docks and warehouses was regularly tested during the year and kept up to the usual standard of efficiency.

ACCIDENTS TO PERSONS IN THE DOCKS.

The number of accidents to persons in the docks was 490, of which 25 were fatal, 89 serious and 376 slight, against 387 cases last year, of which 27 were fatal, 85 serious and 275 slight. Of the fatal cases, 2 were caused by falling into holds or lighters, 6 by falling into dock basins, 10 by goods falling out of slings, and 7 were due to other causes.

A dock clerk was accidentally drowned in the course of his duties and the Trustees granted a pension of Rs. 22 per mensem for the maintenance of his widow and infant son.

ACCIDENTS TO VESSELS IN THE DOCKS.

Two accidents to vessels in the docks occurred during the year, neither of which was serious. In both cases Port Trust Officials were held to blame.

60-TON FLOATING CRANE "SARUS."

There was a decrease in the earnings of this crane which amounted to Rs. 54,035 against Rs. 61,670 in 1925-26. The number of packages lifted during the year was 751 against 805 in the previous year. The heaviest single lift made by the crane was a case of machinery weighing 39 tons 18 cwts.

CRIME IN THE DOCKS.

The return furnished by the Commissioner of Police of cognizable crime in the docks for the calendar year 1926, gives the following particulars which are compared with the corresponding returns of the two previous years:—

	1924.	1925.	1926.
Persons arrested ...	5,752	6,927	8,404
Number convicted ...	5,561	6,764	8,301
Percentage of convictions ...	96.7	97.6	98.8
Number of cases of theft ...	292	244	245
Number of cases in which property was recovered ...	214	209	201
Amount of property stolen ...	45,250	15,909	18,326
Amount of property recovered ...	18,182	4,463	13,960
Percentage of value of property recovered ...	40.18	28.05	76.13

Government have submitted proposals for the reorganisation of the docks and harbour police and the incidence of cost between the Trustees and Government. The Trustees' views have been communicated to Government for consideration.

PORT TRUST COPY OF CUSTOMS BILL OF ENTRY.

On the representation of the Collector of Customs that the practice at Bombay whereby the Port Trust made use of the Customs duplicate Bill of Entry for the purpose of recording the delivery of import consignments was open to objection, as it inconvenienced the Customs audit and statistical work and was contrary to the procedure observed at Calcutta, Karachi and other Indian ports, the Trustees decided to amend the Docks and Bunder By-laws so as to make it obligatory for importers to prepare a true copy of the Customs Bill of Entry which would be retained for Port Trust use and would bear all Port Trust endorsements. The change has worked satisfactorily and has assisted to expedite disposal of claims for refunds, etc., besides eliminating much correspondence that formerly took place in regard to delay in the return of documents to the Customs House.

COMPENSATION IN LIEU OF CAPITATION OF TROOPS

In response to representations from the Government of India, the Trustees agreed to fall into line with other Indian major ports in regard to the levy of port charges on military personnel, their equipment, baggage, horses, etc., so as to conform to the provisions of the Indian Army Tolls Act, 1901. Under the agreement which came into force with effect from the 1st April, 1927, Government vessels are exempted from the levy of port dues and wharfage on stores and equipment for vessels' own consumption as also wharfage on military and naval personnel, their horses (other than remounts), baggage, carriages and other effects forming part of the authorised scheduled equipment of the unit to which such personnel belong. It was further agreed that, in consideration of the abolition of the capitation charge of Rs. 2 per head, the Trustees should levy a charge for compensation for loss of revenue calculated at two annas per ton of gross registered tonnage of the vessels for each day that the vessels are employed in transport work and

that the concessional rates of dock dues at Ballard Pier and No. 18 berth Alexandra Dock should be withdrawn. It is estimated that the financial effect of this scheme based on the figures for 1925-26 would represent a loss of approximately Rs. 30,000 per annum to the Trust.

REDUCTIONS IN CHARGES AT THE DOCKS.

The following reductions and concessions in the Docks Scale of rates were sanctioned during the year:—

- Liquid fuel discharged from tankers dry docking for repairs and subsequently re-shipped, to be charged full import wharfage only instead of full import and export.
- Goods certified by the Customs as having been detained for special examination were exempted from the levy of extra fees during the period, plus two working days after release.
- Wharfage rate of Rs.1.80 per ton was adopted to apply to consignments of lubricating oils imported in bulk. The first steamer to discharge bulk axle oil was the ss. *Palembang*, which discharged 2,100 tons through the pipe line, and substantial saving in costs should result from this concession.
- The note to item 46D (Section I) was amended as a convenience to shippers so as to authorise the levy of wharfage at the net rate of eight annas per ton (plus surtax) on manganese ore shipped and supported by Port Trust Railway weightment certificates.
- The Board authorised the Docks Manager to allow vessels to work during the midday and evening meal intervals and also from 6 a.m. to 8 a.m. without additional charge in cases of special emergency.
- The craneage charges for the docks 2-ton, 5-ton and 15-ton steam cranes were reduced by approximately 33½rd per cent., in order to attract more traffic to the Port Trust Railway, and encourage importers to make greater use of the cranes. The Docks Manager was empowered to waive the full extra fees incurred on imports loaded into railway wagons, owing to short or late supply of wagons, and also the charge for steam cranes requisitioned, but not utilised owing to non-supply of wagons.
- The wharfage rates on lubricating mineral and vegetable oils (packed) which were based on a 10-gallon unit were reduced and amended to a 'per gallon' basis, in order to enable the Oil Companies to derive full benefit from the smaller packing of 6-gallon and 8-gallon units principally adopted by the trade.
- In order to encourage the importation of china-clay in bulk for discharge direct into railway wagons for storage at a central distributing depot at the Mazagon-Sewri Reclamation, the Board approved of a special wharfage rate of Rs.1 per ton against the ordinary rate of Rs.2 per ton for china-clay imported in casks. The first vessel so dealt with was the ss. *Elmpark*, which discharged 7,000 tons working continuously with seven quay cranes and fifty special high-sided railway wagons of twenty tons capacity; an out-turn of well over 1,000 tons per nine-hour working day was attained.

VERNACULAR SCHOOL AT WARI BUNDER.

The number of pupils on the rolls of the primary vernacular school, maintained by the Trustees for the education of the children of dock labourers, was 114 on 31st March, 1927, against 123 in the previous year. The school was inspected by the Superintendent, Municipal Schools, and a grant of Rs.500 was made by the Municipality. The net expenditure to the Trustees on the school was Rs.2,011.

PORT DEPARTMENT.

During the year 169 day tours and 70 night tours of inspection were made by the special officer in charge of this work. The number of light passes granted was 3,367 against 3,392 in the previous year. 256 lectures were given which were attended by 7,027 tindals and boatmen, against 267 lectures attended by 6,610 tindals and boatmen in the previous year.

DONATION TO SIR LESLIE WILSON HOSPITAL FUND.

The Trustees were pleased to sanction a donation of Rs.5,000 to the Sir Leslie Wilson Hospital Fund under the provision of the Indian Ports Act.

PILOTAGE DEPARTMENT.

There were seven slight accidents to vessels while in Port Trust pilotage charge during the year. On four occasions the pilot in charge was held to be at fault.

The wireless communication between the Port Signal Station and the Prongs and Kennerly Lighthouses and the Steam Pilot Vessel was fairly consistent throughout the year. The secondary means of communication by helios and night signalling lamps also worked well at all the stations.

CAPITAL (Expenditure and Works).

CAPITAL EXPENDITURE.

The aggregate expenditure on Capital Account during the year was Rs.21,80,891 apportioned over the various works as follows:—

		Revised Estimates.	Actuals.
		Rs.	Rs.
Section I.	Prince's Dock	1,800	1,243
	Victoria Dock	1,900	1,882
	Merewether Dry Dock	21,400	24,490
	New Works, Ordinary	9,68,900	5,92,356
" II.	Alexandra and Hughes Dock Works ...	16,69,500	14,70,890
" III.	Port Trust Railway and Depots ...	1,86,600	90,030
		28,49,600	21,80,891

This outlay was met as follows:—

	Rs.
From Loan Balances for New Works, Ordinary ...	5,62,677
" Alexandra and Hughes Docks loan balances ...	14,70,890
" P. T. Railway and Depots loan balances ...	90,030
" Sale proceeds of property	57,294
	21,80,891

PRINCE'S AND VICTORIA DOCKS.

The work of providing additional lighting in the docks consequent on the Trustees undertaking to accept responsibility for goods discharged at night was completed during the year under report.

MEREWETHER DRY DOCK NEW CAISSON.

The erection of this caisson was completed and the caisson was put into commission from 3rd April 1926. The old caisson was towed to the east of the harbour and scuttled on 21st October 1926.

NON-PROPELLING BARGES AND FLATS FOR DREDGER "WALRUS."

The erection of 3 new flat barges, 400 tons each, was completed during the year and the barges were successfully launched. The material for 3 new hopper barges of 300 tons capacity each was received from Messrs. William Simon and Co. and one barge was erected and launched in February, 1927. The work on the remaining two barges was in hand at the close of the year.

MANOEUVRING WINCHES FOR DREDGER "WALRUS."

The fitting of these winches was completed during the year under report.

DEVELOPMENT OF PORT TRUST LAND AT COLABA.

A seal coat of Spramex was applied to the new roads laid out on the old Colaba Cotton Green and the carriageway handed over to the Municipality. Further progress on the work has been suspended in the absence of any demand for the land.

EXTENSION OF PORT TRUST WORKSHOPS.

The following electric plant was installed at the Workshops during the year under review:—

- 5-ton overhead electric crane in the new machine shop.
- Electric blower in blacksmith shop.
- Electric motor in the old machine shop.
- A Quasi-arc welding set.

The electric lighting of the old and new machine shops was also completed.

LIQUID FUEL PIPE LINE.

The extension of the liquid fuel pipe line to berths Nos. 14 and 15 in Alexandra Dock was taken in hand, and a new masonry culvert 123 feet in length was constructed. The work was about half completed at the close of the year.

HARD FOR LOCAL CRAFT.

This work, which was commenced in August, 1924, to provide facilities for repairs to small craft, was completed during the year and brought into use.

FORTY FOOT WEST OF SEWRI STATION.

To improve communication between the Development Department chawls at Sewri and the Sewri Station, this road was constructed during the year.

MAKING VICTORIA BRIDGE ROAD TO MUNICIPAL REQUIREMENTS.

11,604 square yards of road surface on the approaches to the Victoria Road Overbridge were covered with a 2 in. layer of asphaltic concrete. This work was carried out by the Bombay Municipality at Port Trust cost.

PORT TRUST RAILWAY.

Three locomotives of the number surplus to requirements were sold during the year to Messrs. Burn and Co., for Rs. 60,000. Seven other old engines were sold by auction for Rs. 14,850.

ALEXANDRA AND HUGHES DOCKS.

The expenditure on these docks during the year amounted to Rs. 14,70,890 making a total of Rs. 6,07,50,085 since the commencement of the work in 1904. The following are the principal details of the expenditure during 1926-27:—

	Rs.
Transit shed at No. 9. berth	6,75,398
Deepening entrance channel	2,84,843
Deepening mail steamer berth at Ballard Pier	1,55,793
Paving and metalling of wharves	1,26,682
Office for Deputy Manager and Cash Department	77,007
Providing iron roller paths for cranes	30,754

The construction of the new three-storied transit shed at No. 9 berth, Alexandra Dock, measuring 396 ft. long and 121 ft. 6 in. wide, was completed and handed over to traffic on 8th May, 1927. The floor area available in this shed for the storage of goods is 128,900 square feet.

The deepening of the entrance channel to 28 ft. below L.O.S.T. and of the mail berth to 32 ft. is proceeding satisfactorily according to programme. The revised estimates for this work aggregate about Rs. 26½ lakhs.

The wharves at berths Nos. 2, 8 and 9, and measuring 473 squares, were paved with sett stones on a 6 in. cement concrete bed. To provide increased open storage accommodation for berths Nos. 8, 9 and 11, the open plot at No. 10 berth was paved.

A new office for the Deputy Manager, Alexandra Dock, and the Cash Department was constructed at the north end of the dock and the work was almost completed by the end of the year.

About 2,900 lineal ft. of cast-iron crane roller paths were let into the granite copings of the dock walls. The work is still in progress.

SPECIAL REVENUE WORKS.

IMPROVED PASSENGER TRAFFIC FACILITIES.

During the year under report, the following improvements were carried out to provide greater facilities for passengers by coasting steamers:—

- 1½ bays at the north end of No. 14 shed were partitioned off to form a waiting room.
- Teak benches were provided in the waiting room.
- 8 seats of latrines and 3 urinals with septic tank on full flushing system were provided at sheds Nos. 14 and 15.
- 2 seats of latrines were added to the existing latrines at "M" shed, Prince's Dock.

ROLLING FENDERS FOR BERTHS NOS. 18 AND 19, ALEXANDRA DOCK.

Two special rolling fenders were provided for berths Nos. 18 and 19, Alexandra Dock Harbour Wall.

MAINTENANCE DREDGING.

The total quantity dredged during the year on revenue account was 5,525,000 tons as against 3,544,500 tons in the previous year 1925-26. The increase is due to the dredging in connection with the oil pier at Pir Pao. The average cost per ton on maintenance dredging was 3.18 annas per ton as compared with 3.53 annas in the preceding year.

BOARD OF TRUSTEES.

During the year under report, 31 general meetings of the Board and 47 meetings of the Committees were held as against 36 and 30 respectively in 1925-1926.

STAFF.

The total approximate number of employees engaged during the year as compared with the two previous years was as under:—

	1926-27.	1925-26.	1924-25.
Permanent—Superior	1,994	1,096	2,149
" —Inferior	451	451	490
Temporary Staff	10,337	10,886	12,804
Total	12,782	13,333	15,443

HOUSING OF STAFF.

In view of the financial position and the reduction in the number of staff in consequence of retrenchment, no further expenditure was incurred during the year on housing.

Out of the total staff of 12,782, the number housed in the Trust buildings is 4,965 or 34.8 per cent.

ATTENDANCE AT DISPENSARIES.

The average daily attendance at the Trustees' Dispensary at Prince's Dock was 68.12 against 68.14 in 1925-26 and 79.65 in 1924-25. There were 1,042 cases of injuries against 950 in the previous year. 1,916 sick certificates were granted. At the Wadala Dispensary, the average daily attendance was 13.13

against 13.3 in 1925-26 and 18.37 in 1924-25; 175 cases of accidents were treated and 280 sick certificates were issued against 116 cases of accidents and 350 sick certificates issued in 1925-26. At the Antop Village Dispensary, the average daily attendance was 40.9 against 44.5 in the previous year; 72 cases of injuries were treated and 525 certificates issued. At the Grain Depot Dispensary, which was started from November, 1926, the average daily attendance was 20.4 and 311 cases of injuries were treated; the number of sick certificates granted was 77. During the year 1926-27, there were 24 deaths in the superior and 6 in the inferior staff, as against 20 and 10 respectively in the previous year.

REVISION OF PROVIDENT FUND RULES.

The Provident Fund rules of the permanent and temporary staffs were revised with effect from 1st April, 1926, to comply with the provisions of the new Provident Funds Act, XIX of 1925. Opportunity was also taken, in the case of permanent employees, to provide for the application of subscribers' contributions to the Provident Fund being applied either wholly or partially to payment of subscriptions to a recognised Family Pension Fund or of premia on a Policy or Insurance on the subscriber's life. This concession has proved very popular and a number of subscribers are taking advantage of it by insuring their lives.

AMENITIES FOR STAFF.

With a view to providing further amenities to their employees of all grades, the Trustees have applied to Government for an amendment of the Bombay Port Trust Act, to empower them to institute an "Employees' Welfare Fund." During the year under review, a Co-operative Credit Welfare Fund was formed for Bombay Port Trust employees, and registered under the Co-operative Societies Act by Government. The society is making good progress.

RETRENCHMENT INVESTIGATIONS.

The consideration of the remaining proposals submitted by the Special Retrenchment Officer (Mr. H. N. Heseltine, C.I.E.), was completed during the year under report and further retrenchments were effected wherever feasible. The following are the principal items of retrenchment approved by the Board during 1926-27:—

Provident Fund.—Withdrawal of 1/11th increase to temporary employees on admission to the Provident Fund. They were however given the option of qualifying for a retiring gratuity in lieu of joining the Provident Fund.

Overtime.—Calculation of overtime pay was to be made at 1/30th of pay instead of 1/26th and principles for payment of overtime were definitely laid down.

Conveyance Allowance.—This was reduced in the case of the dredging staff.

Railway Staff.—Considerable reduction was made in the cadre of the staff of the Port Trust Railway.

The post of Deputy Chairman which was created in the first instance for a period of two years, was brought on to the permanent cadre on a reduced scale of pay. Mr. W. R. S. Sharpe was confirmed in the appointment with effect from 24th March, 1927. He proceeded on seven months and seven days leave from 6th June, 1927.

The scales of pay for the Secretary and Deputy Secretary were reduced. Mr. N. H. Morris was confirmed as Secretary vice, Mr. W. R. S. Sharpe and Mr. A. S. Bakre, Indian probationer, was appointed Deputy Secretary.

Captain E. V. Whish, O.B.E., R.I.M., Port Officer, proceeded on twelve months combined leave out of India from 14th January, 1927. Captain H. A. B. Digby Beste, O.B.E., R.I.M., was appointed by the Government to officiate as Port Officer vice Captain Whish.

The Trustees were again pleased to record their appreciation of the excellent work done by their officers and staff in all departments during the year. The depression in trade and the necessity of curtailing expenditure without impairment of efficiency combined to make the year one of some difficulty. There are no indications so far of any substantial revival in trade, but the trustees have complete confidence that their officers will continue to give their whole-hearted co-operation in retrenching expenditure during this period of trade depression.

WIRELESS ON TRAWLERS.

An interesting instance of the value of wireless to trawlers in their fishing has just been reported by an English trawler captain. He was on a certain fishing ground one day, recently, where fish were being obtained in large quantities. The only other trawler within this area was a French one which was fitted with wireless. The captain of the French trawler used his wireless set and telegraphed to other French trawlers belonging to his own company, with the result that within a few hours twenty other French trawlers had arrived on the same fishing ground and all of them steamed away with heavy catches.